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Common Battery for Small Exchanges.

BY S. P. GRACE.

The efficiency and economy of operation of common battery telephone systems have been thoroughly demonstrated during the last six years. All of the new plants of any considerable size, both Bell and Independent, are being equipped as common battery systems. It has been frequently proposed to use common battery for even the smaller exchanges but the expense necessary for a power plant and batteries has always been prohibitive. For example, a 150 branch exchange if the distance was great, but if not too far, a condenser system was used. That is, about 20 microfarads were bridged across the charging lines at the branch exchange and all local branch lines taken off the condenser bus-bars. It has also been the practice of the Bell Long Distance Co. to use composite telegraph and telephone lines. That is, the alternating voice currents and the impulses of direct current for telegraphing were sent over the lines at

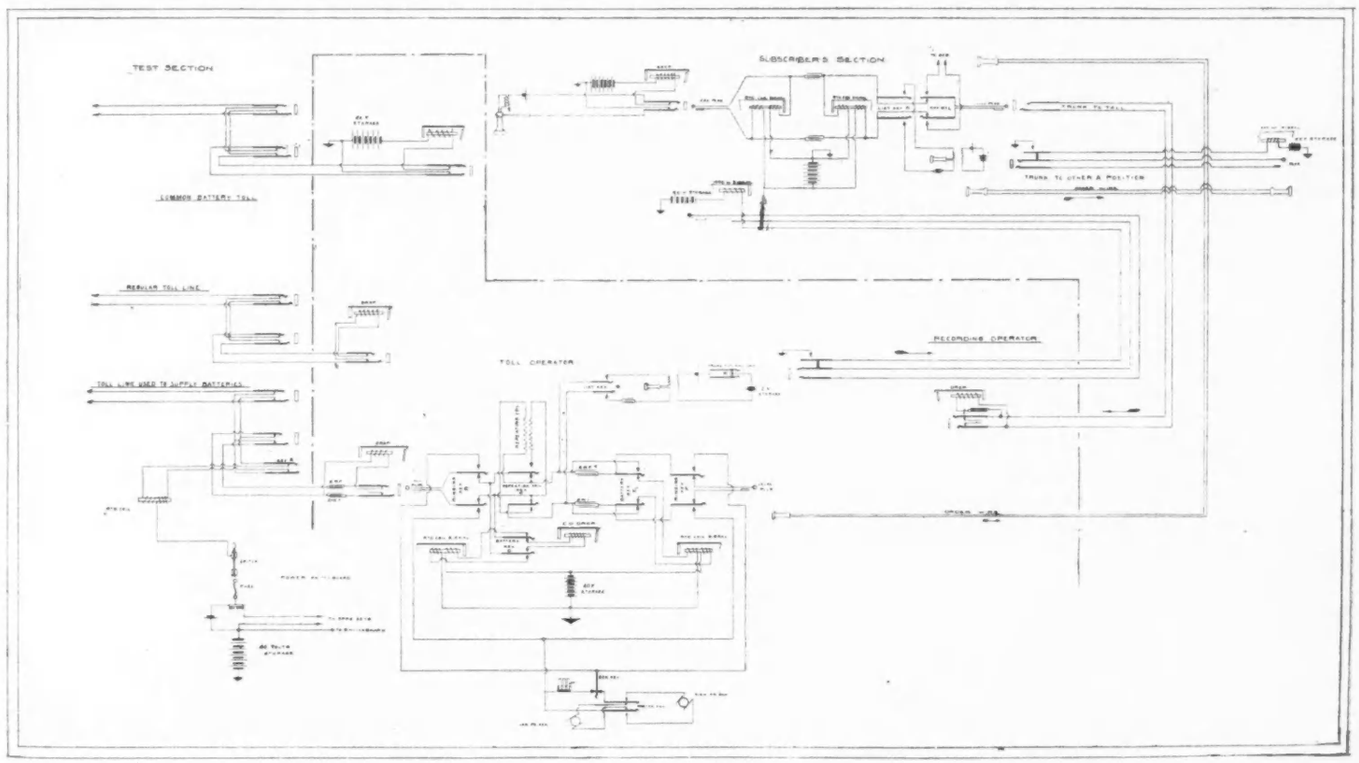


FIG. I.

capacity switchboard would cost about six hundred dollars and the power plant under the usual conditions about the same amount. Furthermore, the expense of keeping an employe at an exchange of this size, who would be familiar with power apparatus, would be too high. The power apparatus would undoubtedly in the majority of plants of this size be misused. Primary batteries for common battery systems cannot be used because of the expense of maintenance and because of their high internal resistance which produces cross talk. For some time past, the Bell companies have been supplying battery to their private branch exchanges in cities over several pairs of cable conductors. Sometimes they installed small storage batteries at their

the same time without interference. This is done by a proper combination of resistance capacity and self induction, the voice currents being too weak to actuate the telegraph instruments and the telegraph currents being so rounded out as not to be audible in the telephones. It occurred to the writer that it might be possible to transmit sufficient battery over the toll lines to small town exchanges and still be able to talk over the toll lines at the same time. To demonstrate the feasibility and economy of this plan the following calculations and experiments were made.

In the transmission of a definite amount of electrical energy over a line, the loss will be the smallest when the current is the least. The loss in the line will vary as the

square of the current. That is, if a certain amount of energy is being lost over a line with a certain current the loss will be quadrupled if we double the current. For Watts= Volts times Amperes and Volts=Resistance times Amperes or $W.=V.\times A.=R.\times A^2$.

Consequently, for high efficiency we must so arrange our apparatus as to be obliged to transmit the smallest possible current over the lines and also to charge practically continuously. By charging continuously we can use a low rate of charge and therefore secure a high efficiency in both our batteries and transmission lines.

At these small exchanges with the above mentioned system of battery supply, we must eliminate all waste of current, and have a board that will require the minimum of electrical energy. Boards having circuits, as shown in Fig. 1, meet these requirements.

The circuit shown in Fig. 1 is a retardation condenser transmission system. In this system, when a subscriber removes his receiver from the hook, the line signal will come in, and when the operator answers it will be automatically restored. The signal may be of the shutter type and mechanically restored by the plug or arranged to fall back automatically when the current is removed by the insertion of the plug. The current is supplied for transmission through retardation coils in the cord circuit. These retardation coils are double wound and are also provided with a visual target. These supervisory signals will remain set as long as the subscribers are talking. The average current supplied to the subscribers' line will be 1/15 amperes. 1/15 amperes at 40 volts will be 2.7 Watts. Let us assume that the average length of connection is three minutes and that the number of calls per day per subscriber is ten, then the Watt hours used per subscriber per day will be $1/15\times40\times3/60\times10=1\ 1/3$.

Increase this amount by thirty per cent to allow for leakage, crosses, etc. This will bring the Watt hours per subscriber per day up to 1 7/10. This allowance is certainly ample to take care of all leaks, etc. The Watt hours required per subscriber per year will be $365\times1\ 7/10=720$. It is proposed to use 20 cells at the small exchange, 19 of which will be for exchange work and one for operators transmitters. The operator's transmitter battery will generally be overcharged, but it is more economical to use it in this way than to cut down the current on a 40-volt pressure with resistance.

Suppose it is desired to transmit current to a fifty-line exchange over a toll line whose resistance is 100 ohms, charging continuously.

Since each subscriber requires 1 7-10 Watt hours of electrical energy per day (including proportional amount of all leaks, crosses, etc.), 50 subscribers will require 85 Watt hours. This energy will be supplied by storage batteries located at the exchange, but charged over the toll line. Assume the efficiency of these batteries to be 80 per cent, for they will have a slow rate of charge and discharge and consequently high efficiency. Furthermore, during a considerable part of the time when the load on the exchange is light the board will get its battery directly from the toll line without battery transformation, the local batteries merely carrying the overload. So the efficiency will be at least 80 per cent. If the efficiency is 80 per cent, 106 Watt hours will have to be furnished at the terminals of the battery to make up for the loss.

Since 106 Watt hours per day are required at the battery terminals and we are charging for 24 hours, against a 40-volt pressure, then the current in the line and batteries must be $106\div(40\times24)=.11$ amperes.

If .11 amperes flow over a 100 ohm line, the voltage drop will be 11 volts, consequently the initial pressure required to drive a current of .11 amperes over a line containing 100 ohms resistance and 40 volts counter E.M.F. will be 51 volts.

Then the energy required to be furnished the line at the charging end will be $51\times.11\times24=134.5$ Watt hours. Suppose the charging station is equipped with motor generator and storage batteries.

The efficiency of the motor generator combination may be taken as 64 per cent and the battery efficiency at 70 per cent. The combination efficiency would be $64\times70=44.8$ per cent. But during the hours of charging the current supplied to the toll lines for charging batteries in other exchanges will not have to undergo battery transformation at the charging end. Therefore, the efficiency may safely be taken as 50 per cent at the charging station or twice as much energy has to be supplied to the charging station as can be taken from it. Therefore, to obtain 134.5 Watt hours from the charging station 269 Watt hours would have to be supplied from the electric power mains. The usual price for electric power is six to ten cents per Kilo-Watt hour; 269 Watt hours would therefore cost 2.69 cents, or it will cost for current for the 50-line exchange charged over a 100 ohm line 2.69 cents per day. This is at the rate of 19.6 cents per subscriber per year. The table in Fig. 2 has been computed on the above basis and shows at a glance the cost of current for different sized exchanges charged over lines of various resistances.

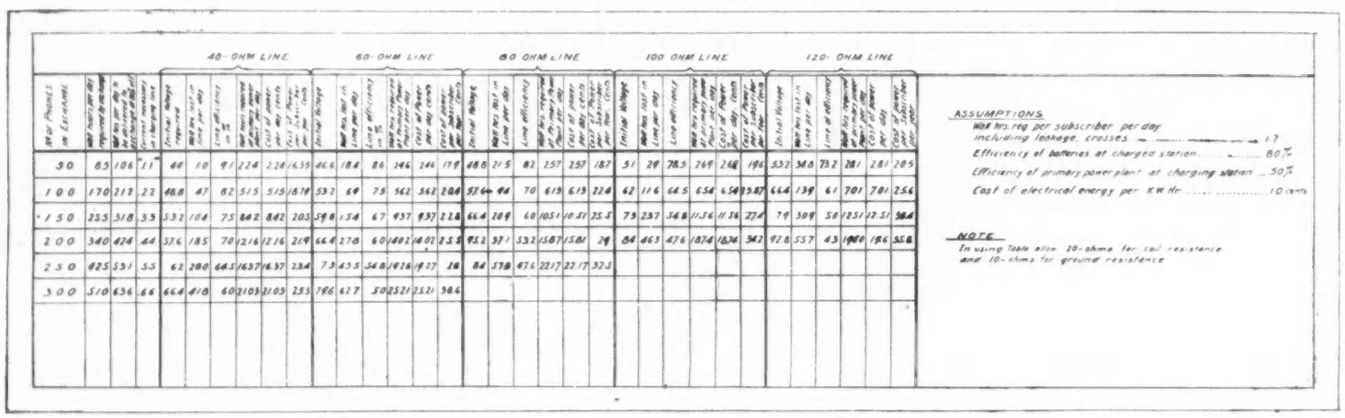

40-OHM LINE
60-OHM LINE
80 OHM LINE
100 OHM LINE
120-OHM LINE
ASSUMPTIONS
Watt hrs. req. per subscriber per day including leakage, crosses 1.7
Efficiency of batteries at charged station 80%
Efficiency of primary power plant at charging station ... 50%
Cost of electrical energy per K.W. Hr. ..... 10 cents
NOTE
In using table allow 20-ohms for coil resistance and 10-ohms for ground resistance

FIG. 2.

In calculating the table it has been assumed that the initial voltage obtainable would not exceed 90.

On this assumption 250 subscribers is the limit of an 80 ohm line, 200 of a 100 ohm line and about 190 of 120 ohm line. The highest price in the table per subscriber per year for battery is 35.8 cents and the lowest 16.35 cents. The average price will be about 25 cents. If a 6-cent per Kilo-Watt hour rate is obtained the average cost will be only 15 cents per subscriber per year. This is less than the cost of two sets of dry batteries per year, which would amount to at least 90 cents, including installation labor. Therefore we are able to get all the benefits of the common battery

system with a scheme of this kind, and at a much less cost for maintenance. The first cost of installation in each case will be about the same for the cost of the storage batteries, fuse panel, etc., will be offset by the decrease in the price of 'phones caused by the absence of generators.

If we had used primary batteries of the Gordan or Edison Lalande type to generate this energy, the cost would have been much greater. For example, to produce 40 volts with either of the above batteries it will require 60 batteries.

For a recharge of 1,000 ampere hour cell of either of the above types it costs about $3.00 and for recharging 60 it will cost $180.00 or $180.00 for 60,000 Watt hours, or .3 cents per Watt hour; 85 Watt hours at .3 cents per Watt hour will be 25.5 cents. The cost per day for battery for the 50-line exchange above mentioned supplied over the

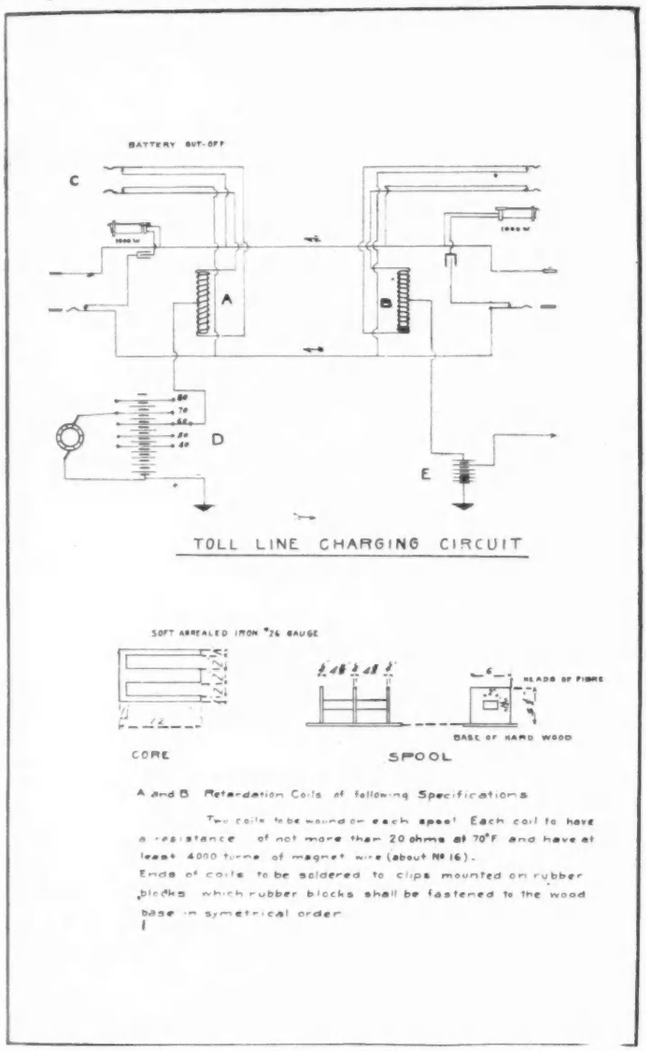

BATTERY CUT-OFF
C
A
B
D
E
TOLL LINE CHARGING CIRCUIT
SOFT ANNEALED IRON #26 GAUGE
HEADS OF FIBRE
BASE OF HARD WOOD
CORE
SPOOL
A and B Retardation Coils of following Specifications
Two coils to be wound on each spool. Each coil to have a resistance of not more than 20 ohms at 70°F and have at least 4000 turns of magnet wire (about № 16).
Ends of coils to be soldered to clips mounted on rubber blocks which rubber blocks shall be fastened to the wood base in symetrical order.

FIG. 3.

toll line was 2.69 cents. If supplied by primary batteries at the exchange the cost per day will be 25.5 cents. In a lamp signal common battery system the amount of energy required will be nearly as great as in a drop signal common battery system charged over toll lines, because of the added amount of current required for lamps.

It having been demonstrated by the above figures that this system is economical, it remains to design an arrangement of toll line circuits which will permit of the simultaneous use of battery-charging currents and voice currents without interference. To meet this condition the circuits shown in Fig. 3 have been designed.

By referring to the circuit in Fig. 3, it will be observed that it is possible to feed battery current of any voltage from 40 to 80 or 90 to the toll line.

The positive end of the battery is grounded and the negative end is connected to the center of a retardation coil, which coil is bridged across the toll line permanently. This coil is so designed as to have a comparatively low ohmic resistance, but a high co-efficient of self induction. The series resistance is 40 ohms, but its impedence to an alternating voice current will be extremely high, and so we can bridge it across the toll line without fear of its seriously reducing the voice currents. This coil must be finely constructed and accurately balanced. Under most conditions this ground on the center of the line will not effect it in the least; in fact, it will improve the working of the toll line by allowing the static charge accumulated from the atmosphere to escape. However, if the line should become slightly unbalanced by severe weather conditions and this ground throws any noise upon the line, it is possible for the operator to remove the battery charging current from the line during a conversation by means of key C. For signaling purposes a 1,000 ohm tubular drop is bridged across the line through a 2 M. F. condenser.

A similar set of keys, drops, etc., is used at the receiving end and the center of the coil connected to the batteries. Therefore battery current will flow from positive pole of battery D through the earth, through battery E, through both sides of coil B in parallel, through both sides of toll line in parallel, through both sides of coil A in parallel, back to negative pole of battery D, thus completing the circuit. Battery E will receive an amount of current depending upon the resistance of the coils and the line and the voltage of battery D.

The joint resistance of each coil will be 10 ohms and joint resistance of both coils 20 ohms. The resistance of the ground return will be about 10 ohms, provided that first-class grounds are obtained for batteries D and E. The first battery of battery E will be used for operator's transmitter, the other batteries for the subscribers' lines.

First example:

Suppose we have a 100-'phone exchange 26 miles away from the central charging station, and we have a No. 10 B. & S. copper line available to charge over, what will be the cost per subscriber per year for battery current?

Resistance of No. 10 copper wire per mile, 5.3 ohms.

Allow .1 ohm per mile for resistance of joints, 5.4 ohms.

Combined or joint resistance per mile of both sides of line is 2.7 ohm.

Resistance of 26 miles will be	70 ohms
Resistance of coils	20 ohms
Resistance of ground	10 ohms
Total resistance	100 ohms

By referring to the table it will be found that the cost per subscriber per year for current in a 100-line exchange charged over a 100 ohm line is 23.3 cents, or $23.70 per year for the entire exchange. The charging voltage will be 62 and the current .22 amperes.

Second example:

It is good practice to keep the toll lines out of the cables as much as possible, but it is sometimes unavoidable.

Suppose we have a 150-'phone exchange 19 miles from the central charging station, one mile of which is over No. 19 cable wire and 18 miles over No. 10 copper toll line.

Joint resistance of 18 miles No. 10	48.6 ohms
Joint resistance of 1 mile No. 19	21.2 ohms
Resistance of coils	20 ohms
Resistance of ground	10 ohms
Resistance of fuses	3 ohms
Total resistance	102.8 ohms

By referring to the table it will be found the cost per subscriber per year for current in a 150-line exchange charged over a 100-ohm line is 27.4 cents.

If two lines going in the same direction of this ex-

change had been available the resistance would be cut down one-half (except ground resistance), or 54.9 ohms.

In the table the cost per subscriber per year for 150-'phone exchange charged over a 60 ohm line is found to be 22.8 cents. It is interesting to note that a 50-line exchange can be supplied with current over a No. 10 line 110 miles long at a cost for current per year per subscriber of only 30 cents. One hundred and ten miles is nearly twice the distance across the State of New Jersey. A 100-'phone exchange could be supplied with current over a similar line about 70 miles long. From the above example, it will be seen the lower the resistance of the line the less will be the cost per subscriber per year. Generally speaking, a central charging station can supply a territory of about 20 miles

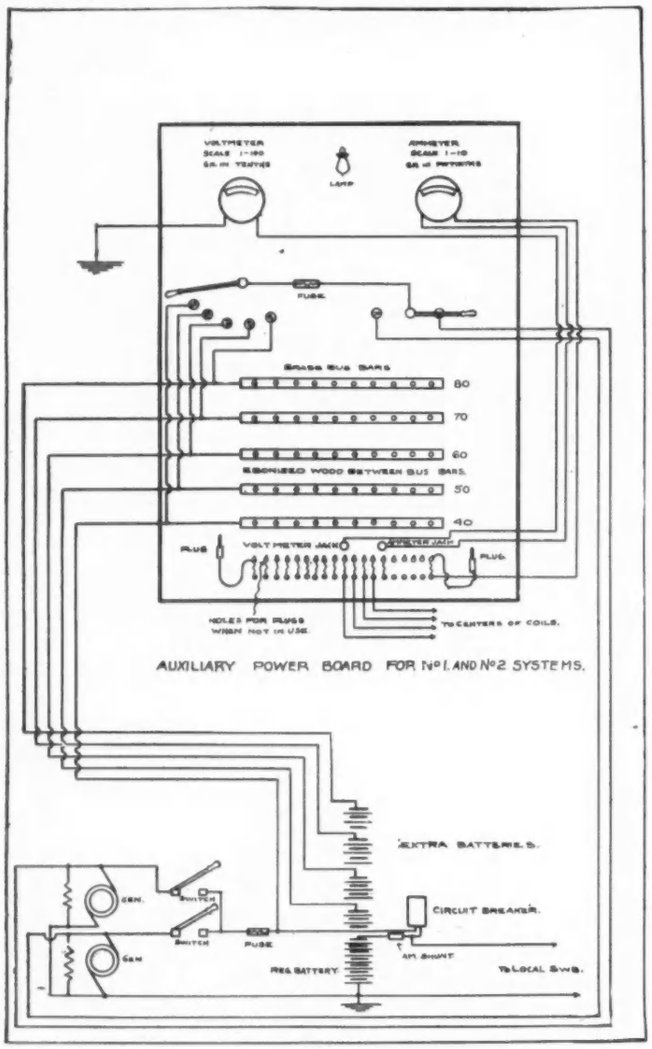


FIG. 4.

radius, providing that there are no large exchanges to be supplied.

It is obvious in a system of this kind that all loose joints, poor contacts in fuses, etc., must be eliminated, otherwise the line will be noisy and efficiency of transmission decreased. In any toll line these defects ought to be eliminated for good service and the battery current will show up at once all defects.

In some localities differences of ground potential exist, sometimes as high as 10 to 15 volts. It is not anticipated that these potentials will interfere seriously with this system, for they are of a static nature, and as soon as it is attempted to take any appreciable current from a source of this kind the potential immediately dies away to almost nothing.

When the battery is switched on or off the line and the line happens to be in use the subscriber will get a slight click in the ear, which will not be objectionable.

The circuit shown in Fig. 3 was thoroughly tested in the laboratory of a prominent telephone manufacturing company's factory, and the writer has also made numerous tests of the same kind on actual working lines of the Bell company.

The 1,000 ohm drop signals work nicely and will fall with four to six thousand ohms in the generator circuit. No trouble is anticipated with the signaling. The coils are of such high impedence that they are nearly opaque to the voice currents and will not seriously shunt the line. It is not anticipated that there will be any bridges across lines of this character, but if necessary other exchanges and toll stations may be bridged across. Regular style bridging instruments, with local batteries will work nicely on a line of this kind. It would also be possible to have two exchanges charged over the same line, but it is not advisable unless necessary.

For the efficient handling of these toll line charging currents it is recommended that a special power plant be installed in the central charging station and a fuse panel in the charged station. It is assumed that the central charging station is already equipped with a full complement of power apparatus for a 40-volt system. With the arrangement shown in Fig. 4 the batteries can be charged in sets of 20-25-30-35-40, and can also be discharged in the same manner. With the voltmeter the power man at the charging station can obtain the voltage of any set of his own batteries, or by plugging any charging line into the voltmeter jack can determine the voltage of the batteries at the distant station. The ammeter can be connected in any of the toll charging circuits and the current being delivered to the distant batteries can be read. Flexible plugs and cords made of electric light cords are used for making the various connections. This panel should be mounted as close to the main power panel as possible. The cost of this extra panel complete with instruments will be about $125.00. In many cases it may be possible to combine this power panel with the main power board and use the regular station instruments which would decrease the cost.

At the small exchanges charged over the toll lines all that is necessary in the way of a power plant are the storage batteries, a fuse panel, and possibly a set of primary batteries as a reserve source of power.

The fuse board shown in Fig. 5 will answer the purpose nicely.

With this board the exchange can be charged from any one of four circuits or all four circuits at the same time. In case of accidents to charging lines the storage batteries can be cut off and the primary batteries used. The storage batteries should be of such a capacity as to allow of the exchange being run two days without charging the batteries. The cost of the above fuse panel with five switches will be about $20.

Judging from the above calculations and experiments there seems to be no reason why common battery systems cannot be installed in small as well as large exchanges, in districts which are thickly populated and where the exchanges are not great distances apart. Exchanges of over 1,200 subscribers should be provided with a complete common battery system, using lamp signals with positive supervision and provided with a complete multiple. The design of these boards should be such as to meet the exacting requirements put up on exchanges in large cities. In exchanges from 300 to 1,200 subscribers the same style of a board, having the same operation as boards for larger cities, should be installed. It should have a complete multiple and the line and supervisory signals should be lamps. Boards of this character should be made so that one position will form a section. This enables one position to be added at a time. In both of the above systems, complete power plants should be installed, and an auxiliary power plant provided for the

charging of storage batteries at other exchanges over the toll lines.

In exchanges from 25 to 300 subscribers a switchboard having circuits similar to those shown in Fig. 1 should be used. In Fig. 1 is shown a subscribers' line circuit, operator's cord circuit, transfer trunks, wiring of magneto toll lines, common battery toll lines, and the wiring of a toll operator's cord circuit. The toll operator's cord circuit is so arranged that two magneto toll lines, two common battery toll lines, or magneto and common battery lines can be connected together with the same pair of cords, simply by shifting different keys. This drawing also shows the arrangement of wiring for the incoming charging current from the toll lines through the storage batteries.

In all the calculations above it has been assumed that a 40-volt system would be used. The writer has made

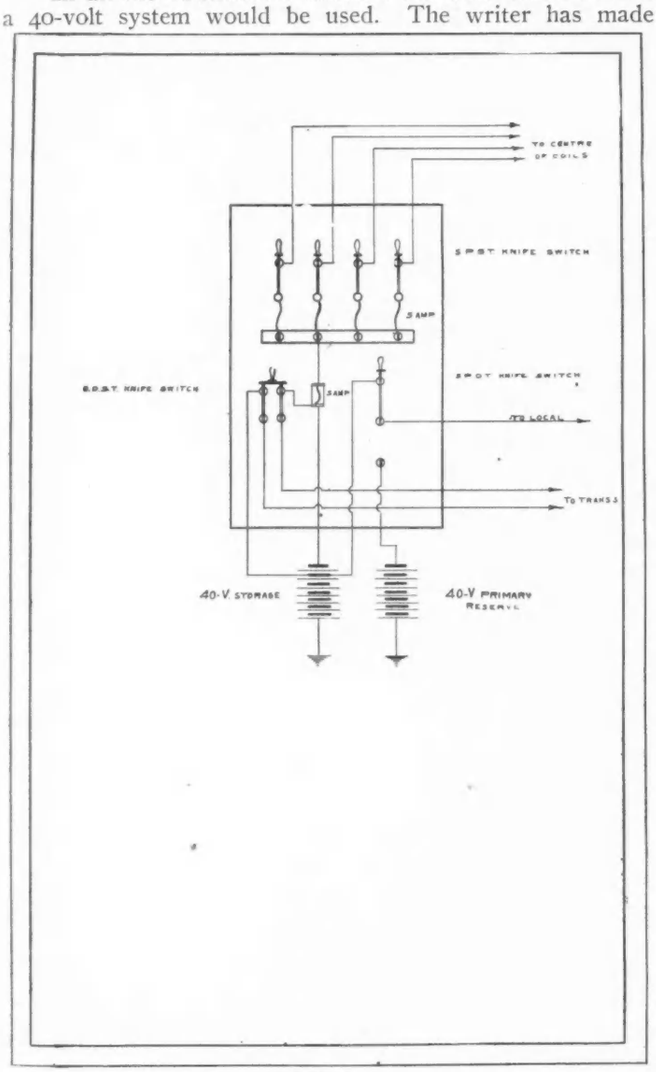


FIG. 5.

experiments with various voltages and has come to the conclusion that a 40-volt system gives the best results, both for articulation and loudness of transmission. With a 40-volt retardation system, the writer has supplied current over a No. 10 copper circuit to telephones 65 miles away from the exchange. The transmission obtained was very good. With a 30 to 35 mile line the transmission was excellent, and was very nearly equal to the best local battery transmission.

As a result of these experiments the writer is convinced that all toll stations can be supplied with common battery instruments, as very few toll station lines exceed 35 miles in length. The wire must, of course, be a No. 10 or No. 12 copper.

It is the intention of the Inter-State Telephone Company of New Jersey to adopt throughout the system outlined above, since their exchanges are very close together, and they will all be connected with either No. 10 or No. 12 copper toll lines. If a system of this kind is properly designed and constructed, there is no reason why it should not be made to work admirably.

WIRE FOR TELEGRAPHING AND TELEPHONING.

The question of the employment of hard-drawn copper for overhead line wire was one concerning which conflicting views were held fifteen or sixteen years ago, when the extensive use of this metal began in the telegraph and telephone service. At that time, and at intervals since then, the advocates of silicon bronze and phosphor bronze wire have urged the employment of those metals for overhead wires, especially for telegraph and telephone purposes, chiefly on account of the greater tensile strength of such wires as compared with hard-drawn copper wire. Indeed, several hundred miles of such wires were experimented with in 1882 and 1883 by the British Postoffice Telegraph Department, presumably in the belief that hard-drawn copper wire was not suitable. The fact, however, that hard-drawn copper wire possesses 98 per cent, of the conductivity of pure copper, has ample tensile strength to support itself on the poles, and is sufficiently ductile to meet all the requirements of practice, has hitherto seemed to telephone and telegraph engineers in the United States a valid reason for employing this metal in preference to silicon or phosphor bronze wire, with but 85 per cent or less of the conductivity of pure copper, even admitting the greater tensile strength and ductility of the latter wires. Of course, for long spans, as over rivers or ravines, the high tensile strength of silicon or phosphor bronze wire would render it superior to the hard-drawn copper article. It may be noted in connection with this subject that the almost total disuse of iron wire for overhead telegraph purposes predicted by many upon the advent of hard-drawn copper wire has not followed and large quantities of iron wire are still being employed for this purpose, as an instance of which it may be stated that one of the largest iron wire works was recently 27,000 miles behind orders for galvanized iron telegraph wire, notwithstanding that the works had been going night and day for over two years. The high price copper during the past few years has doubtless contributed very measurably to this continued use of iron wire.—*Cassier's Magazine.*

TELEPHONES IN ITALY.

The Italian minister of posts and telegraphs has presented a bill with a view to the construction of seventy-three new lines of telephone which will place the principal towns of the kingdom in direct communication with each other. The project also includes the construction of three international lines: Genoa, Vintimilli and Marseilles; Turin, Vintimilli and Marseilles; and Turin, Mount Cenis and Lyons, which will have connections with the Paris-Turin line, which is already being largely availed of. The project will cost upward of 5,800,000 lire and will require eight years to complete. The shorter lines, of which there are fifty-three, will first be constructed.

The Kellogg Switchboard and Supply Company has just closed a contract with the Keystone Telephone Company of Philadelphia for a switchboard for its fourth district exchange of 7,200 lines ultimate capacity and 3,420 lines present equipment. Included in this contract is all necessary power apparatus, distributing frames, sneak current and lightning arresters. This exchange will be complete in all its details and embody the latest improvements.

THE LIFE LINE.

BY STANLEY WATERLOO.

Robert Felton was in luck when he met an Eastern girl in Salt Lake City. He was from Chicago and she from Boston. An inveterate sportsman was Felton and each autumn when he came out to visit a mine in which he was interested the trip terminated with a hunting expedition which extended sometimes to the very edge of the time of storms and snow. Once or twice he and his companions had been nearly caught snow-bound in the mountains and he had acquired experience if not, perhaps, sufficient caution.

He met tall, bronze-haired, gray-eyed Catherine Murdoch, who was on a visit from the East—and that settled it! He fell in love a thousand feet and wooed with all the vigor and persistency he might have exhibited after elk or bear. It didn't take long. The splendid advance of the tempestuous hunter-miner, business man, as cultivated as she, too, somehow fascinated the frigid beauty and she yielded in almost no time. They met in June, were married in September and spent the winter, spring and summer in Chicago. Then, with approaching autumn, came again upon Felton the mountain fever, and he proposed the usual Western trip. He was in love as deeply as ever—and he was a considerate man.

"We'll go to Salt Lake City," he said, "and I'll attend to my business—it's all in town there—and then, dear, you'll let me make a hunting trip, won't you, while you stay in the city and have a good time with Mary?" Mary was Mrs. Felton's cousin.

"Where do you hunt, Bob?" inquired Mrs. Felton.

"Oh, generally away up a canyon, which forks from one where a couple of my friends have a mine. I've had a sort of shack built on the side of this branch canyon, which is about five miles across country from the mine, and, every fall, they send over a stock of provisions—canned goods and flour, and sugar and tea and coffee—and come over themselves when they can, and hunt and fish with me. It will be a little late this year."

"What sort of a place is this shack of yours?"

"It's fine! There are a cook stove and a table and three chairs and a bed. There's a window, too, and there's a litograph of Li Hung Chang tacked up on the wall! It's just voluptuous—makes you think of the Taj Mahal on the outside and the boudoir of the Sultan's favorite in the inside. It's a dream!"

"Bob, I'm not going to stay in Salt Lake City. I'm going hunting with you."

"What?"

The tone of the lady became just a shade pleading:

"Why not, Bob?"

"Madam, you're an honor and a grace to my home, but in a shack in the mountains you would be like La Cigale. Out of your fitting clime and place and your own sweet season, you would perish as does the summer beastie! So go the ephemera! Why, dear, up at the shack there it's only hunting, and fishing, and climbing or falling, and washing tin dishes and eating, and sleeping as sleep the dead, and then doing the same things over again. You're no stone for such a setting."

The charming lady hesitated for a moment and then spoke very thoughtfully and earnestly, though, it must be admitted, with a certain degree of cooingness.

"Bob, I'm afraid I've been negligent—perhaps criminally secretive—but I have failed to make clear to you one side of my character. I wish you to understand, sir, that I have been in the Adirondocks, season after season, that I can swim like a duck, that I can cast a fly and that I can shoot tolerably well. Furthermore, I can cook almost anything in a tin dish. Am I not going with you, Bob?"

There was some astonishment, then a whoop, certain excusable demonstrations, and, two weeks later, his business concluded in Salt Lake City, Felton and his wife were up in the cabin in the mountains and the nickel had been fairly dropped in the Western slot.

It is wonderful when a man is afield with a man companion who understands both him and the woods. It is more wonderful, still, when the companion is a woman, the creature closest to him, and also understands. His old friends of the mining camp came over and hunted with him as usual, and that fair, veneered barbarian cooked famously for them, like a laughing, chaffing squaw, and added two more to her list of fervent admirers. Never were such happy days for Felton as when he fished or hunted with his wife. Woman who well knew the mountains, wise as well as beautiful woman, she had provided herself with a suit for the time's exigency, a suit of thick woolen, ending in knickerbockers and stout shoes. There was a skirt which, by unclasping its belt, could be taken on or off in an instant. She proved sturdy and there is no occasion for telling of the fishing and hunting records of the two. They were most content, and they lingered in the mountains.

One day—it was late for autumn—for the foot hills—Jim Trumbull, one of Felton's two mining friends, over on a visit, said abruptly:

"Felton, it's time to leave. We're all ready to skip."

"I think so, too," said Felton. "These first little snows seem ominous. I imagine we'll get it early in the season. I intend to leave to-morrow night. The burros are all ready."

But the next day Felotn and his wife found tracks and good hunting, and so night found them still in the cabin. At eight o'clock in the evening Felton went out and looked about. There was a great ring around the moon, and the stars had a dim look. "It's like the sky over Chicago," Felton muttered. He slept uneasily and was up at daylight, looking anxiously from the cabin door. Everything had changed. The universe was white. The earth was white and the air was white. He leaped back into the cabin. Breakfast over, the man who had forced himself to eat quietly said:

"Get together a day's food, Kate, and get on your hunting dress, with thick garments under it, as quickly as you can."

She did as he told her and he made swiftly a back-load of the provisions and her skirt and two great blankets. Well knew he that they must reach Parson's Camp or be lost.

They plunged out into the whiteness. They must cross the billowy tongue of high land lying up and down between the two forks of the great canyon. Across this mesa ran a rude trail which none knew better than did Felton, but to feel and keep it with this white shroud of snow upon the ground and filling the air was a feat almost impossible. They plunged ahead into the white depths, for the wind had made the snow deep in the opening, and this depth, while it retarded their progress, was, after all, a God-send. It aided Felton in keeping the trail. What need to tell of the details of that awful day? Darkness was falling when Felton carried an exhausted and senseless woman into Parson's Camp. There was no one there!

Felton struck a match and found a half-burned candle. He gave his wife whisky and water, and, later, food, and she was soon herself, for the trouble was but from exhaustion. Then Felton sat down upon a chair and figured the thing out aloud.

"They thought we'd gone and so did not pay any attention to us. They had sense enough to skip in time."

His wife was up and beside him now.

"What of it?" she said, "we have shelter and warmth, and, when it stops snowing, perhaps, we can dig out." Then, noting his face, she added, "Anyway, we'll be rescued, somehow." Her husband laughed agreeingly:

"Of course," he said, "we're all right." Then he began looking around for food.

He found in one corner a bushel of potatoes, and, hanging beside a bank of shelves where the cook had kept his dishes, there was a good part of a dried deer's ham. Standing on a chair, he peered over the top. There was nothing there.

"We shall have to live on dried venison and potatoes," he said. "They seem to have left most of their stuff up here," and the lady was content.

"We'll have venison in all sorts of ways," she commented. "Here's some salt," and she held up a little bag she had found on the floor.

They supped on what they had brought, and slept in the bunk which, with its belongings, had been abandoned by one of Felton's friends. There passd a couple of blithesome days—to the woman—while Felton, brave liar, smiled and made fires, and puns and love and was sick at heart and full of an inflammatory vocabulary in his inmost being. This he knew, that it was thirty miles to the nearest help and that the miners had probably not yet half-way floundered through the snow lying between them and the town. Without aid from the outside, Felton knew that he and his wife must die.

The snow fell quietly, steadily, remorselessly. When the two should be missed on the arrival of the miners at the settlement it was more than likely that the mountains would be inaccessible until spring.

Felton found an axe and kept himself from desperation by digging out certain trees in a wind-swept, partially clear space one side of the cabin. The trees he converted into firewood, passing the sticks through the window to Kate, who delightedly piled the fuel up in great stacks by the chimney. It was not very cold, and they congratulated themselves upon their store, which was carefully husbanded, for future contingencies.

On the fourth day it ceased snowing, and they could see the world. It was all white. The snow was about five feet on a level about the house. The canyon down which the home trail ran was evenly filled with feathery powdered snow three times this depth. It grew colder, and Felton, at last, told Catherine the truth.

"Dear, I have been lying to you frightfully. There was no food on top of the big shelf. We have enough to live on for four or five days at the utmost. Then we must starve. We are supposed by our friends to be safe, and we cannot reach the outside world. It would take weeks for the most determined men to reach us, from Sharon, the nearest settlement."

Any man should be satisfied with what this woman did then. She but said: "The only reproach I have, dear, is that you did not tell me the true situation at first. Then we could have suffered together, and that would have been better. We have been very happy anyhow, and we are together yet."

This altogether illogical conclusion of her words somehow strengthened Felton wonderfully. He began fumbling around the room. Courage filled his heart, without reason, he felt, but, with courage regained, he was not inclined to quibble as to its source.

"I don't know just why," he said, "but, my girl, you've given me hope. I'll bet the good God will help us."

"'Course he will," responded this dignified, blessed young matron, born and bred in Boston.

"Come," said Catherine, rousing herself from the thoughtful mood which had gripped her after the first excitement of the revelation was over. "We haven't half explored this place. Who knows but there's a barrel of flour stowed away in some dark corner."

"Behind this door, for example," said Felton, entering into his wife's mood, and glad of any little diversion to check thought and imagination.

There had been standing against the wall in one dark corner of the room an old door, evidently brought in from some outhouse for the repairing of its hinges. It had not been disturbed since the new occupancy of the place. Felton grasped the thing in both hands and set it to one side. There, semi-gleaming in the candle-light, hung revealed one of the two business ends of the commonplace and eminently valuable device knowns as the plain telephone of North America!

Felton gasped and then sat down meekly in a chair. "Holy smoke!" was all he said.

Catherine came running to the half-dazed man, but for a little time he said nothing more. He was thinking. He remembered suddenly that there was a telephone between the mine and the nearest town in the valley, that to which the workers had fled. Of course the line was deep beneath the snow most of the way, but it might be working. He looked at his wife in a foolish way, clambered to his feet and took hold of the receiver.

"Don't be disappointed," said Catherine, "if it doesn't work. We shall be saved somehow."

"Hello!" shouted Fenton, into the familiar, waiting 'phone.

Catherine stood by in the silence which ensued, saying nothing.

Moment after moment passed, and there came no answer. Still the man stood there, at intervals of four or five minutes repeating the hopeless word, the call "Hello." Suddenly he upreared himself, laughed somewhat wildly, and applied his lips to the transmitter.

"Hello! Who is this?" came the query from Sharon.

"I am Robert Felton. Tell Jim Worthy or George Long that we are snowed in at Parsons without provisions for more than a few days, and tell 'em to come in a hurry—the trail is from five to twenty feet deep in snow."

"Who do you mean by we—all of the Parsons crowd?"

"My wife is with me—we are alone—the Parsons outfit left the night the storm began."

"All right. Keep a stiff upper lip. There'll be help coming," called the operator, and the bell rung ending the conversation.

Felton could not speak. He sat dumbly waiting, while Catherine chattered to him of commonplace things to win him back to his ordinary frame of mind.

Soon the telephone bell rang again, and this time friendly, well-known voices gave messages of hope and good cheer. It was rumored that the men from Parsons camp were on the way—but, so far, they had not arrived. Men and horses amply supplied with tools, with provisions, with everything needful, would leave the valley at once for the work of rescue.

"But how long can you hold out?" at last broke in one of the heartsome, friendly voices. "It may take us ten or even twenty days to shovel through to you—can you stand such a siege?"

"We'll do our best," returned Felton over the wire, "but, the truth is, we are pretty short of food, so take no chances!"

They were already living on carefully measured out rations and Felton resolved to reduce his own portion below the meager amount he had already given himself.

"Keep up heart, we'll help you—good-bye!" So ended this talk with Worthy and Long.

The days dragged. The wood chopping, the fire keeping, the story telling to beguile the weary hours, went on. Once or twice a day came a message of good hope from Sharon. The rescuers were off, and in the shortest time possible would reach the beleaguered couple.

Then one morning there came a sharp, unexpected, insistent ringing of the bell, opening wide the door of the world to these two who were making their one meal from scraps of dried meat, while almost the very last of the treasured rations were in their hands at the moment.

"Hello!" called Felton, at the 'phone in a moment.

"Hello! That you Felton?"

"Yes—this isn't Tom, is it?"

"Yes—of course, Tom, just in from Parsons—been hearing about you. We left in a hurry—mighty lucky, too, or you wouldn't have had the telephone connected and ready for business."

It was one of the men from Parsons camp.

"They've reached Sharon!" said Felton to Catherine.

"Say!" came Tom's voice over the wire, "you've found the stores, haven't you?

"What stores?" almost yelled Felton. "We found a little dried venison and some potatoes in the cupboard, but they are all gone."

"—— a tenderfoot, anyway!" shouted Tom—then, recollecting himself, he went on. "Take up a board there over by the table. Where do you expect to find provisions if not in the cellar?"

Down went the hand of Felton, and away he sprung to the square pine table near the door. Taking up a loose board, he gazed into what Tom called the cellar—a square hole under the floor, filled with boxes and kegs and tin cans of meat and vegetables and biscuits.

"Catherine!" he called, but Catherine was already there, kneeling by him, her arms around his neck. She was crying, the brave girl, and Felton was conscious of a sneaking desire to follow her example.

"But won't we feast!" at last Catherine spoke. And then she ran to the telephone to send her own special message to Tom, and to the whole Parsons outfit, and it is certain that there never went over the wires a more grateful and gracious thankfulness than was expressed by Catherine and Felton upon this occasion.

And so, with renewed life, the two awaited events, and one day, toward noon, they heard through the stillness a faint sound, a sort of metallic clink, and a little later they were sure of the welcome ring of men's voices. Felton fired off the loaded rifle which hung over the cabin door at Parsons and soon came an answering volley of pistol shots and a faintly heard "Hurrah!"

Felton seized his own snow shovel and began madly working through the drifts in front of the door. His efforts looked puny in the waste of snow, but it was a relief to his nerves to be active, and Catherine joined him, laughing and royally flourishing the Parsons broom.

It was some time before the rescuing army of miners and cowboys reached the little lane which Felton and Catherine had cut out and swept for them—scarce ten yards it reached from the doorway. And then—well, then it was but a few days back to the world—that world which had been saved to Felton and his wife by the life line, the wire stretched over and through the snow between mountains and men.

NOVEL CHARGING SYSTEM FOR TELEPHONES.

A new way of charging for telephone service may come into use if the invention recently patented by Thomas Baret of Sydney, New South Wales, meets with general approval. He proposes to charge for the total length of the conversations and not for the total number. His meter consists of a clockwork device which is at rest except at such time as conversation is being held, and then it is at work registering the actual time consumed by the talk. The up-and-down movement of the switch-lever throws the clock into action, shuts it off and keeps it wound.

DECISIONS AFFECTING TELEPHONY.

Prepared for TELEPHONY by Andrews & Murdoch, Berrien Springs, Michigan.

TELEPHONE COMPANIES AS PUBLIC CARRIERS.

O. E. Payne and others, a co-partnership doing business as the Keystone View Company, made application recently to a St. Louis, Mo., court for a writ of mandamus against the Kinloch Telephone Company. The writ was denied in the lower court, but the Court of Appeals of St. Louis has reversed this decision and granted a peremptory writ, enunciating a rule of law for the conduct of telephone companies important for all managers to know.

The facts in this case were undisputed. The respondent, the Kinloch Telephone Company, operates two systems —one consists of instruments located in public places, like hotels or drug stores, which any person may use at any time for a small toll; and the other a system of private instruments, placed in the offices or buildings of subscribers, under special contract, and under just and reasonable rules governing their use. In March, 1900, the following contract was made by the parties, under which the relators subscribed for an instrument to be placed in their business quarters, as follows:

"St. Louis, Mo., March 7, 1900. We hereby agree to rent of the Kinloch Telephone Company at our place of business, No. 3443 Laclede avenue, one telephone on copper wire metallic circuit, for the period of five years, upon the following terms and conditions: (1) To pay $60 per annum, in quarterly payments, said payments to be made in advance. (2) We agree to use said telephone as long as we require the use of a telephone, not to exceed five years. (3) The time of the beginning of the term to date from the installation of the instrument. (4) The telephone furnished to be and remain the property of the Kinloch Telephone Company, which company shall have authority to remove the same for nonpayment of the rental after reasonable notice. Keystone View Company, per M. I. Payne, Pres."

The View Company paid the hire of the telephone until the first day of October, 1900. It worked badly and messages could not be received and transmitted over it satisfactorily. The subscribers complained of its defects from time to time, and attempts were made to put it in good working order, but without success, until about the 15th day of December. In the meantime they had become so dissatisfied with the appliance and tired of waiting for it to be adjusted properly, that they notified the respondent on the 31st day of August—that is, a month before the expiration of the time for which they had paid, to remove it. Respondent disregarded several notices of this kind, and on the 15th day of December the instrument was finally adjusted so that it rendered good service, and the View Company was then willing and desired to retain the use of it, and so notified the respondent, tendering it on the 3d day of January the sum of $15.00 for the quarter next ensuing, and offering to pay them $5.00 for the service during the time the instrument had been efficient prior to said date. Respondent demanded pay for the entire time the instrument had been in appellants' house, regardless of whether it worked or not—that is, insisted on being paid for the time from October 1 to December 15—though there was no evidence tending to prove the telephone was of any use to the appellants during that interval, in spite of said tender and appellants' notification that they wished to retain the instrument after it became efficient, respondent removed it on the 4th day of January, 1901, and has since that time refused to restore it unless paid for all the time it was in the building at the usual rates. The claim is put forward that one rule of the company is not to reinstate a telephone which has been removed for nonpayment of rent until all back payments have been made and the cost of reinstallation,

amounting to $17.00, also paid in advance (although the latter item was waived by the manager or superintendent of the company in this instance). The alleged rule in regard to when an instrument will be restored to a subscriber or reinstalled on his premises is not among any of the printed rules of the company furnished to subscribers, nor is it in the form of a printed rule at all, nor was it communicated to relators when they made the contract with the respondent, or even communicated to them until they demanded a continuance of service by the respondent.

The telephone company, while admitting these facts, contend against the mandamus that, while it is a common carrier in respect to its first or public system, it is not a common carrier as to others, and is only bound to serve persons with whom it contracts on terms, conditions and regulations made by it. The precise issue raised in the case was whether or not the respondent was bound to install a telephone on the relators' premises on their demand and tender of one-quarter's rent in advance, plus the unpaid rent for the time they enjoyed good service from the telephone.

The court held, in substance, that a telephone company sustains such relations to the citizens of the territory in which it operates that it is bound to enter into a contract with a citizen to furnish him private service when requested and accompanied with an offer to pay the usual charge in advance; and where an instrument has been removed, and the customer is solvent, and it is fairly doubtful if any back rent is due, or the subscriber has paid for all the actual former service rendered, it cannot exact as a condition that it be made whole for back rent claimed and the cost of the reinstallation; and the fact that it maintains public toll stations for the use of the general public would not justify its refusal to furnish service.

The following extracts from the opinion of Justice Goode will be of interest:

"Telephone companies have been held from the first to be common carriers in the sense that they are bound to furnish service to any one offering to comply with their reasonable requirements, not only in respect to their public stations system, but also as to the so-called private system of instruments installed in offices, residences and places of business. State vs. Bell Tel. Co. (C. C.), 23 Fed. 539; State vs. Delaware & A. Telegraph Co. (C. C.), 47 Fed. 633; State vs. Bell Tel. Co., 36 Ohio St. 296, 38 Am. Rep. 583; Chesapeake & P. Tel. Co. vs. Baltimore & O. Tel. Co., 66 Md. 399, 7 Atl. 809, 59 Am. Rep. 167; Bell Tel. Co. vs. Commonwealth (Pa. Sup.), 3 Atl. 825; Hockett vs. State, 105 Ind. 250, 5 N. E. 178, 55 Am. Rep. 201; Telephone Co. vs. Bradbury, 106 Ind. 1, 5 N. E. 721; Central Union Tel. Co. vs. State ex rel. Falley, 118 Ind. 194, 19 N. E. 604, 10 Am. St. Rep. 114; Same vs. State ex rel. Hopper, 123 Ind. 113, 24 N. E. 215; State vs. Bell Tel. Co., 22 Alb. Law J. 363; State ex rel. Webster vs. Nebraska Tel. Co., 17 Neb. 126, 22 N. W. 237, 52 Am. Rep. 404. In the cases above named the duty of an incorporated company operating a telephone system in a certain locality to treat all citizens of that locality alike, and to give them all equal privileges in regard to the use of the system by entering into contracts with them and installing instruments on their premises, is recognized and upheld, as well as the power of the courts to compel the observance of this duty by a writ of mandamus. Some of the decisions are founded on statutes more or less positively prescribing the duty, and others on the common-law rule that a common carrier, or other company or person holding itself out as ready to serve the public at large in some business intimately and essentially associated with the general social and business life of the community (especially if such person or company is operating under or enjoys some advantage or franchise from the state), is bound to serve every member of the community without discrimination or partiality; and some of the decisions which are supported by a statute declare the power to enforce the obligation would exist, if there was no statute, by virtue of the principles of the common law, of which the statute is said to be declaratory."

WELL KNOWN HEADS OF WELL KNOWN HOUSES

Mr. Fred Byron Patten, the subject of this sketch, was born in Fairfield, Ill., March 22, 1873. He attended the country schools, the Rockford high school and finished his education at the Northwestern University, Evanston, Ill. After leaving college Mr. Patten traveled for several years, covering the entire Western country, after which he was associated with his father in the brick and tile business. He then entered the Independent telephone field, building an exchange at Sandwich, Ill., which has since developed into the Northern Illinois Telephone Company, owning and operating twenty-five hundred telephones and over seven hundred miles of toll lines. Mr. Patten was the moving spirit in building this system and held the position of secretary and general manager when he resigned from the

FRED BYRON PATTEN.

company the first of the present year to personally look after his manufacturing interests. At this time he was interested in a number of exchange and toll line properties and was largely interested in one of the leading telephone construction companies in the West. While retaining many of his interests, Mr. Patten has, since the first of the year, devoted all his energies to the Illinois Electric Specialty Company, of which concern he is president and general manager. The company manufactures ohmmeters, duplexers, pole changers and many other telephone specialties. Mr. Patten is widely known in the telephone field and is a young man of considerable promise. He has made his way to the front by hard, conscientious work and enjoys the confidence and respect of his business associates. He is courteous and affable and his success has been due entirely to his own efforts.

The Telephone in Telegraphy.*

BY J. J. NATE.

I thank you for the honor conferred. I appreciate it highly, from the fact that I am not addressing an audience composed of gentlemen who pursue the ordinary business walks of life. I know that I am talking to some of the brightest men in the country, men who have devoted years to the pursuit and development of their chosen calling, and it is not my intention to address you technically—yet it is the technical side of the telephone question in its relation to telegraphy that has most interested me in your discussions here. I have remarked with pleasure—and must refer to it as a feature that emphasizes the privilege you have accorded me in permitting me to address you—that you have manifested such an interest in the telephone side of your work. Each and every member of this Association has shown a desire to investigate this fruitful subject of the telephone, and its relation to telegraphy, and has offered his contribution to your discussions. I have attended a great many telephone conventions, at no one of which have I seen exhibited a greater interest than that which has developed during your convention covering the past three days. This simply demonstrates the fact that the telephone has come into railway service to stay, and is going to remain as a permanent feature in your work, and will be developed along broader lines more and more, as its value in your service becomes more prominent. It is not fanciful to predict even wireless telephony and its application to your necessities. You are all familiar with many of the experiments which have been made, and know what has been accomplished with regard to telephoning from moving trains, and many other points connected with the telephone in its relation to telegraphy.

The question was mooted a little while ago here in your discussions as to simultaneous work. This afternoon when you visit our factory, I shall be very glad to have the gentlemen who are interested in this department of your work confer with our engineers, Messrs, Haubrich, Willis, Edison, Davis and others, who will very carefully furnish you any information which you may want along these lines. It is a work that we have been developing and carrying forward for some time.

Very few, if any, of you know that to the telegraph service of this country belongs the credit—if I may so express it—for the first transmission of the human voice over a Western Union telegraph line, back in 1878 or thereabouts, and at a time before there was any idea of the telephone service as it now exists. At about that time the C., M. & St. P. R. R. had extended one of its branches to Plattville, Wisconsin. H. H. Beebe was an operator there; and a gentleman, whose name I believe was Robbins, was located at another point along that line—possibly at Beloit, Wisconsin. Beebe was an inventive genius, and had read something of experiments made by Bell, Grey and others, in transmitting the voice over a wire. There was very little done with the telephone commercially at that time. It was practically considered by telegraph men—who were perhaps the best informed on electrical matters of that character—as a scientific toy. Beebe, however, was a mechanical genius, and he immediately applied this talent to the construction of an instrument that would talk. This instrument he first used on a short Morse circuit, connecting his 'phone with the depot.

I have seen the transmitter Beebe used, and it is practically constructed along the lines of the Riese transmitter—an open and closed proposition.

A little later Beebe one day connected this instrument in on the main line to see how it would work, calling Robbins with a key, he hummed into this transmitter "Yankee Doodle," and the familiar strains vibrated the relay in unison at Robbins' station, and Robbins sent back over the wire the significant expression—"What in hell have you got on the line?"

This same transmitter was afterwards equipped with an adjusting spring, and later, in conjunction with a pair of crudely constructed telephones, was worked on a line between Plattville and Lancaster, over which President Grant carried on what was probably his first telephonic conversation. This happened on the occasion of his return from his triumphant trip abroad. These incidents are matters of history. I have seen published reports pertaining thereto in the Plattville local paper, and reported at that time. I think this was without question the first record of the transmission of the human voice over a telegraph line, in which a transmitter was used. It is true that previous to this time Professor Elisha Grey had worked successfully his musical telephones on lines between Chicago and Milwaukee, but these were not actuated by the human voice, and the magneto receiver was not then perfected.

Another thing that has impressed itself upon my mind during your deliberations here has been the wide range of inquiry covered, and the points raised in discussions in regard to line troubles, testing to locate the trouble, method of connecting up circuits, inductive results and other causes pertaining to telephone lines in railway service. The Bell Company have an absolute formula, which enables them to locate with the greatest certainty and precision line and instrument troubles. I have no doubt but that their engineers—Mr. Carty or Mr. Pickernell—would favor you with such formula if you desire it.

As to the liability of trouble arising in telephone circuits; these are not really any more probable or marked than is the case on telegraph lines. When we say that a telephone line frequently gets into trouble, we must also admit the same with regard to telegraph lines. When we discuss the probability of having simply one pair of telephone lines going down, and of that circuit being our sole dependence, we must remember that in telegraph service the condition is similar, except where the system has developed from one wire to a large number of wires. There is in use to-day on many roads a multitude of wires; and when the telephone becomes a larger factor in railroad service an equal number of wires, if necessary, will be provided, and the facilities for telephoning vastly extended and enlarged. There is no valid reason why the telephone system may not be made as efficient in railroad service as the telegraph has become.

As to the working of a telephone line in connection with a quad system; I understand it has not proven a success so far. Many engineers claim that it never will; but the combination has been successfully operated over Morse circuits for many years. While I do not make this statement from personal knowledge, I remember that when the long-distance telephone lines were constructed by the Bell Company between Boston and New York, it was stated that these lines were leased for telegraphic purposes, at an annual rental of about ten per cent on the cost of constructing the lines. These wires were used at the same time for telephones, and they have been simultaneously operated, so far as we know, ever since. I understand that between New York and Chicago nearly every circuit is leased as a telegraph circuit in addition to the work of telephoning going on all the time. The solution of the telephone problem is simply to string more wires as you find the volume of business over these lines growing larger.

As stated—there is a further probability of wireless tel-

*Paper read before the Association of Railway Telegraph Superintendents at Chicago, June 18, 20.

ephony becoming a success. At St. Paul or Minneapolis, recently, experiments were made with wireless telephoning across the river, which were successful. Why not the same for moving trains, with wires strung along your pole lines? These are matters of moment, which have yet to be fully developed, and no doubt will be in time.

Now, as to the value of the telephone in railway service; I am indebted to Mr. Annette for some data on train dispatching by telephone. This matter was incorporated by me in an article published about a year ago, covering the work performed in the elevation and construction of the Illinois Central St. Charles Air Line across the many tracks on 16th street, this city. I do not know how many of you may have read that report, and I am sorry I have no copy with me. However, there were thousands of cars and hundreds of engines handled over that line, back and forth, crossing over all of the intersecting lines, and all were successfully dispatched. There were, I understand, no accidents, and copies of reports were taken as the trains were dispatched from one station to another. These reports were accurate in every instance. This is a most marvelous record. The work was performed under conditions where probably the telegraph would not have as efficiently served the purpose as the telephone. This opens up the question of how much greater a factor the telephone may become when used in this way.

Some years ago it was my misfortune to be present when the wreck at Chatsworth, Illinois, was being cleared up. The train pulled out of Chatsworth about midnight, and was ditched fifteen or twenty minutes later about three miles further on. One of the train crew was obliged to walk back to Chatsworth for the purpose of obtaining assistance. Doctors were called from there at different points along the line from the town. Those who arrived at the scene of the accident somewhat later found the poor sufferers—men, women and children—moaning in their agony, and it was some time before they could be extricated. If there had been a telephonic means of communication between that train and Chatsworth or Peoria, available at that time, it would have saved many precious minutes—for half an hour means a lifetime to a human being in suffering.

About the same time—or perhaps a little later—when the Illinois Central was constructing its double track at Kankakee, one of the fast trains went through a section gang, killing several and wounding many more. One of the train crew was obliged to walk back to the city for assistance, and there was from one-half to three-quarters of an hour of valuable time—meaning everything, lost. This loss of time could have been avoided by an instantaneous means of communication—such as would have been provided had it been possible to at once connect a telephone to the telegraph wires near the scene of the accident. The calling of aid for the injured is one of the sad applications of telephony—a use which many have found necessary. We can readily appreciate the great value of such a means of communication in case of accident or breakdown on the rails.

You are all familiar with the necessity of constant communication in railroad yards, and here the telephone is most efficient, securing many details of information—such as car numbers, makeup of trains, report of crews, switching instructions, location of lost cars, broken rails, and many other uses.

Let us suppose that a train is laid out between blocks, and that the mechanism has become inoperative, the telephone affords a means of communication direct with the controlling station. Not long ago the Chicago papers reported the loss of a train in the snow, and failure to locate it for two long weeks, during all of which time passengers must have suffered much inconvenience—perhaps sickness and business losses. If there had been a telephone equipment on that train it would have been located even before it could have been said to have been lost. Think of the discomfort on a train thus laid up, if even for twenty-four hours, on one of our Western roads, with stations many miles apart. With a pair of wires worked simultaneously over the pole line, or a straight bridged proposition, it is only necessary to provide the train with telephones and suitable connecting apparatus for attaching to these wires, and one is able to call up any station on the line. These appliances could also be used by section men, construction trains, and in fact under all conditions where necessary to save time or applicable. Conductors could report from intermediate points relative to time, accidents or delays. A means of connection could be in the nature of long poles with terminals at each end, arranged to clamp over the wires, with connections for attachment to the telephone sets at the lower end, or the main wires could be tapped and brought down near the ground on the telegraph poles, at intervals of a few miles apart. The proper connections could be contained within an iron box. Thus a means of communication between trains, section gangs, in fact between passengers on board a train, could be established. Business men might even attend to important matters; railroad officials could be informed of the true state of affairs, and information secured from outside points.

As to train orders; there is little liability of errors when you remember that every order must be repeated back and copied in duplicate. If it is stated that errors do not occur in telegraph practice, it may be considered as an amiable prevarication, for that errors do occur is known to all of us. A friend of mine sent a dispatch not long ago with the address No. 2002 ——— street. It was delivered at No. 202, and now my friend is defendant in a suit for breach of promise. (Laughter). As a matter of fact the telegram was not delivered, and the original shows very plainly the correct address—No. 2002. So there are errors in sending telegrams, as there always will be in every department of business so long as human nature is fallible.

Now, in reference to the time required for connections over the long distance lines: Someone has said here that it takes two hours to get your party if the telephone wires are busy. I do not recall having received a reply to any telegram I have ever sent in much quicker time. As a matter of fact I am waiting yet for a reply to some telegrams that I have sent. (Laughter). The situation, after all, is simply this: the telephone gives you a better average of service every time.

The patent question is one which has also been discussed here. Yesterday I took occasion to stop in at our attorney's office for the purpose of investigation. I did not intend to go into it extensively. I find, however, that the fundamental patents are still in force, but have only a short time longer to run. You are perfectly safe in proceeding along the lines on which you propose to operate at the present time for the development of your simultaneous circuits. You have nothing to fear on that score. The independent telephone manufacturers are already preparing to make apparatus on which patents are soon to expire. We do not advise any one to infringe a valid patent, and we have endeavored to always avoid doing so; but when we know patents are soon to expire, we get in readiness for the manufacture of a protected article, just as other business men do in their lines where a certain product has been protected by patent.

Another point: the independent telephone manufacturers have sold a great many thousands of telephones. As an illustration: this afternoon you will visit our factory, which has been running day and night for nearly two years, and from which we have been turning out an average of fifteen thousand telephones per year; and this is only the work of one factory. In Ohio, Indiana, Michigan and Pennsylvania, to say nothing of the other Central Western states, there are to-day more miles of independent toll

lines, and more telephones by three times over, than those states had ever known before the independent telephone people came into the field.

I am not here to exploit the independent companies. I simply wanted to enlarge upon some of the points which it has occurred to me would give you further food for thought as you develop this work, and I am very glad indeed to have had the opportunity of coming before this honorable body at this time.

In conclusion there is one point I wish to touch upon. I presume it is very natural that every young fellow—perhaps some of the older ones—who has learned telegraphy, feels that with the incoming of the telephone in telegraph service he may lose his job. Yet the introduction of telephony into more general use in railway service will have rather a beneficial effect, for the railroad companies cannot afford to put in a telephone here and there, and with it only a fifteen or twenty dollar operator to manipulate it. The class of men who will be entrusted with this part of the railway business will command at a telephone just as much money as they ever did in the telegraph service; you must have ability in such work; railroad companies must and will protect the lives and property entrusted to their care; they cannot afford to jeopardize these interests by the employment of an inefficient operator at a cheaper salary. You simply change your operator from one condition in the service to another, and one presenting broader opportunities than when he was tied to the key. I can cite you many an instance where the telephone has brought about for an ambitious young fellow the best of results. There is nothing like knowing who the man is you are talking to; like feeling over the wire the vibration of a voice that comes strong and true; like knowing in this way that a bright and capable young man is at the other end of that wire, and that he is there for a purpose—one which he is fulfilling. You recognize this fact, although you do not see his face. That voice becomes imprinted upon your memory; you want to meet him; want to know who that bright young man is, or who that clerk is at that particular station; he who is taking care of everything so rapidly and so successfully. You find him out and he is recommended for promotion and advancement. He might sit at a telegraph key year after year, and other than being complimented in the office for his quick work, he does not begin to stand the show that the man does who operates the telephone under similar conditions. Just think that over, gentlemen.

I thank you for your kind attention. (Applause).

THE TELEPHONE CLEARING HOUSE.*

BY A. L. HUTCHINSON.

Looking at the business of Independent telephone companies from the standpoint of success, their management heretofore has not been all that could be desired.

And I am not aware that other states have made much further advancement than has been made by the companies of Wisconsin.

I repeat here what I have said on several former occasions, that those engaged in Independent telephony are too often men who make the telephone business a side issue in their business affairs, giving it only a small percentage of their attention, and then seeking to apply the same principles which are applied to other business.

It is a fact that the dangers and pitfalls which menace the success of the Independent telephone companies in the future are not those created by the waring competition of the Bell company and its allies, but rather by those men connected with the Independent telephone companies, who seek to control their management by rules inapplicable to the telephone business.

*Paper read before the Wisconsin Independent Telephone Convention at Waupaca, June 25, 26, 27.

It is a business in which there is no room for the narrow-minded, close-fisted pessimist. No matter what capital he may represent or personally control, if he is not broad-guaged enough to grasp the full and complete scope of Independent telephony the quicker he gets out of the business the more he is doing for its success. No business requires the undivided attention of those engaged in it.

With 200 distinct operating companies in Wisconsin, many of them connecting with each other, and all forming a single great system, a business is being developed which requires the closest attention to details to make it a complete success.

Heretofore the general basis for the division of fees has been that each company made its own rates, not only between stations on its own lines, but between stations on its lines and stations on the lines of connecting companies, each company collecting and keeping all fees for all business originating on its own lines, and in some instances these arbitrary rates have been such that it would cost the patron more to talk from A to B then it would cost to talk from B to A over the same lines, a condition which has perplexed the patron not a little since the layman understands that electricity, unlike water, runs up hill as easily as down hill.

But I understand that this meeting of the State Association will adopt a uniform schedule of rates, which shall be applicable at least between the stations of connecting companies, and which should, as far as possible, be applied by individual companies between stations on its own lines, so that there will be a uniformity of rates throughout the state. As Independent telephone companies are not in competition with each other, such an agreement cannot be called a trust, nor can the companies be censured for combining to fix rates.

Having adopted a schedule of rates between existing companies the question of checking messages, toll charges, messenger fees and other extra charges, and settling balances between connecting companies becomes one of great moment to every company.

If each company were to check up and settle its business with every other company in the state over whose lines there has been transmitted through messages, each company would have a herculean task to perform.

There is but one correct way of checking messages and settling accounts between various companies, and that is the method adopted by banks in settling their balances with each other.

The business between the stations of a single company is settled through the principal office of that company, but to settle the business between the various companies there must be a central office to which each company shall report, and which central office shall have authority to settle and adjust all joint business for the various companies.

Realizing the great need of a uniform schedule of rates, and realizing the urgent necessity of a central office for checking messages, adjusting and settling balances between companies, I have anticipated the wants of the companies and have incorporated under the laws of the state of Wisconsin, a company known as The State Telephone Clearing Company, whose functions are to receive reports of all business between connecting companies, ascertain their correctness, and adjust and settle the balances at stated periods.

Although a complex undertaking for each company to attempt to check and settle its business with every other company, it is but a simple proposition when done through a central clearing company.

The modus operandi is as follows:

The clearing company furnishes each company at cost with two forms of message slips. One form for messages received, the other form for messages sent. The two forms are exactly alike except that one is on yellow paper, and

the fees are entered under the word "charged;" the other on green paper and fees entered under the word "collected." All entries are to be the same. At the end of each week each station transmits to the clearing company all message slips of all messages passing between it and the station or stations of connecting companies. The clearing company then brings the sending and receiving slip for each message together and if correct the fees are apportioned to the several companies over whose lines the message has passed and each company credited with its proper amount; if there is a discrepancy in the fees collected and charged, the error is corrected and the station whose slip is wrong is notified to make the correction.

The station at the end of the month is then able to send its own company a correct statement of all joint business. At the end of the month the clearing company strikes a balance between the various companies reporting to it, sends each a copy of the balance sheet, and draws a sight draft in favor of the company having a balance due it against the company having a balance owing. No money passes through the clearing company, but its drafts in favor of creditor companies must be honored by debtor companies. It is possible through the simplicity of the clearing office scheme to settle the balances between a dozen companies by a single draft.

Not only will each company have its toll business more carefully looked after, but it will also know that it receives every cent it advances for messenger or other extra services. Not only does the clearing company make the work absolutely simple, but it can do the work at a trifling cost compared with the expense incurred by each company attempting to adjust and settle its own business with that of every other company.

The fees fixed by The State Telephone Clearing Company is one cent for each message to each company sharing in the toll charges for such messages. Thus if A transmits a message to B, A and B would each share in the toll charges and each would pay the clearing company one cent. If A transmits a message to E via the lines of B, C and D, then each A, B, C, D and E would share in the fees for that message, and each would pay the clearing company one cent.

These fees may be small—they certainly are none too large—but the State Telephone Clearing Company has adopted them and will enter into written contract with any and all companies in Wisconsin to do the work outlined for a period ending May 1st, 1907.

Each company pays for its message forms, which are furnished at actual cost.

The State Telephone Clearing Company is the only company in existence whose sole business is to adjust and settle the business between connecting telephone companies, and I think it will be and is apparent to all that its existence will fill a want long felt.

DECISIONS AFFECTING TELEPHONY.

Prepared for TELEPHONY by Andrews & Murdoch, Berrien Springs, Michigan.

TAXATION.

A section of the act of the legislature incorporating the city of Medford, Oregon, provides that—

"The city council shall have power to license, regulate or prohibit telephone and telephone companies using the roads, streets or alleys of the city and road district, and to fix the compensation which such companies shall annually pay to the city for such license or privilege. But no license shall grant an exclusive right to any such company."

The city council adopted an ordinance providing that no person shall engage in the telephone business, or place in or occupy any of the streets with its poles and wires, without paying, for annual license so to do, the sum of $100, and when this sum is paid the city recorder shall issue a license to the person, authorizing and permitting said person or company to engage in the telephone business within said city for the period of one year; and that the person or company paying said license fee, during the year for which they have paid such license, shall have a right to occupy the streets or alleys with its poles and wires, etc. The ordinance further provided that no person or company desiring to operate any telephone line within the limits of said city shall receive a license so to do, until it files its written agreement with the city recorder not to charge, either directly or indirectly, any greater sum that $1.50 per month to any resident of said city for services and use of a telephone.

The Sunset Telephone and Telegraph Company has contested the validity of this ordinance by commencing suit to enjoin the city from removing its poles and wires, on its failure to comply with the terms of the ordinance.

The United States Circuit Court for the district of Oregon has just passed upon the matter, holding the ordinance invalid in both particulars.

With reference to the license fee, District Judge Bellinger, quoting from Laundry License Case, 22 Fed. Rep.

" 'The power to license, as a means of regulating a business, implies the power to charge a fee therefor, sufficient to defray the expenses of issuing the license, and compensate the city for any expenses incurred in maintaining such regulation. Whenever it is manifest that the fee for the license is substantially in excess of what it should be, it will be considered a tax, and the ordinance imposing it void.' If the city is authorized under its charter to fix the compensation which shall be annually paid for such license or privilege to use the roads and streets of the city, then the city might have required the payment of the sum fixed by the ordinance for such use. But it did not do this. From the averment of the bill, it appears that the complainant has the right to use the streets of the city, by permission of its lawfully appointed officers. If so, the city cannot add new conditions to the grant after the company has accepted it and established its plant. If by the power to fix compensation is meant the compensation that the city is to receive for the license regulation, the case is within the rule of the laundry license case, and the compensation to be fixed must not go beyond the expense of issuing the license and maintaining the license regulation. In short, the city cannot add to the conditions upon which the right to use the streets was granted to the complainant, and, while it may exact compensation for the license, it cannot, under the power given in its charter, make such compensation a matter of revenue."

Sunset Telephone & Telegraph Co., vs. City of Medford et al., 115 Fed. Rep. 202.

MUNICIPAL REGULATIONS.

The common council of the city of St. Paul, Minnesota, granted permission to the Northwestern Telephone Exchange Company, in accordance with its request therefor, to extend its telephone poles and wires along certain streets, and upon condition that the commissioner of public works should designate the location of the poles to be extended, and that the extension of the system should be acceptable to and approved by him. In making the extension the commissioner of public works refused to act, or pass upon the matter in any way, for arbitrary and unjustifiable reasons, and the company proceeded with its work, resulting in the arrest of the manager for violation of an ordinance prohibiting excavation in any street. The supreme court of Minnesota in affirming his conviction, holds that under the permission granted, the company had no authority to locate its poles and extend its system without securing the commissioner's action, as required by the permit, and that the proper course for the company to pursue was to institute mandamus proceedings to compel the execution by the commissioner of his official discretion or judgment.

City of St. Paul vs. Freedy, 90 N. W. Rep. 781.

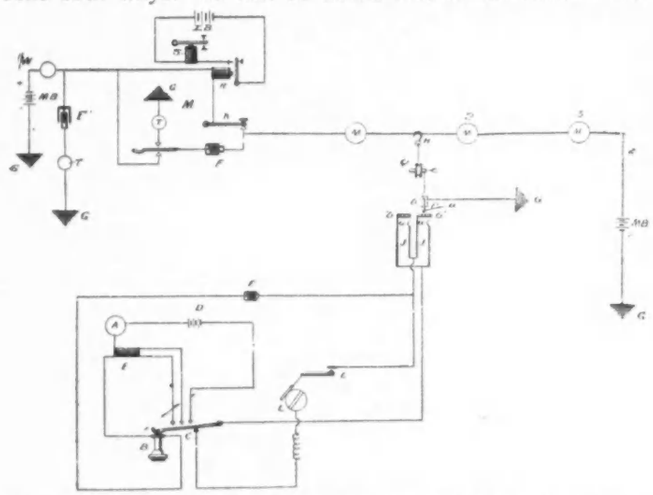
Digest of Telephone and Kindred Patents.

CONDUCTED BY EDWARD E. CLEMENT.

MAY 27.

700,911—E. L. Granel, signal for composite telegraphic and telephonic transmission.

This is a system of signaling for special calls, such as emergency or telephone, over telegraph circuits employing Morse or other code transmission. In the figure M M^1 M^2 M^3 are stations along such a line, each having the usual sending and receiving apparatus, such as is shown on the left, with a telephone set indicated at T, adapted to be cut in at will by a hook switch. In every case the telephone circuits are interrupted for direct current by a condenser, so as to permit superposing of the currents or simultaneous transmission, without disturbance. The invention lies in adapting a separate set for connection at any point of the line so as to constitute a bridge whereby signals may be sent both ways. It will be noted that in the main circuit



700,911—SIGNAL FOR COMPOSITE TELEGRAPHIC AND TELEPHONIC TRANSMISSION.

shown two batteries are employed, serially arranged to reinforce each other. When the hook H is placed on the line at a point intermediate of the batteries it connects the plug P, whose sleeve b is grounded. The separate or portable set has two jacks for this plug, from which connections are permanently established to the generator of pulsating current, L, and the telephone set A, B, having the induction coil E, battery D, and condenser F. The connections to the pair of jacks J J are respectively reversed with regard to the generator L, so that by placing the plug P in one or the other the pulsating currents may be reversed in polarity on the line. When the generator is actuated, these currents will flow over the line in both directions to the terminal grounds. In one direction the pulsations will operate the ordinary relays, giving a characteristic signal which may mean "telephone," or may be an emergency call. In the other direction the relays at the stations on the main line will not be actuated, because the pulsatory current will be opposed by the main battery. Thus a special call may be sent over either division of the telegraph line, without "tapping" or cutting the line, except as stated, without special apparatus, and without interfering with any signals already on the line, except in the receiving end temporarily so employed.

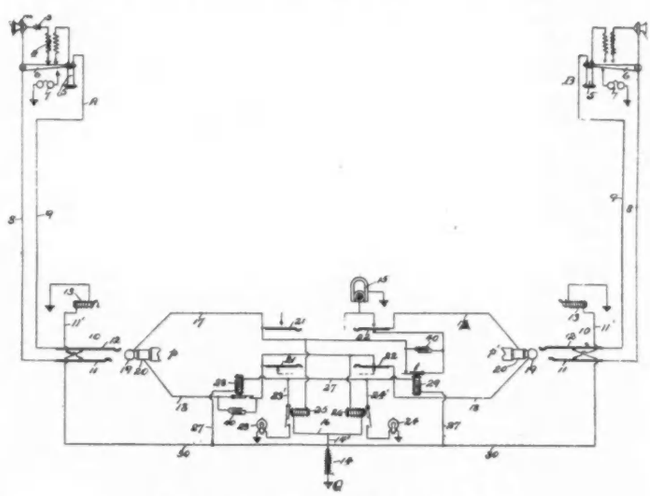
701,152—H. P. Clausen, Telephone System.

This is a system employing a common battery at the central office for signalling, but local batteries at the subscribers' stations for talking. The use of a common signalling battery enables the cord circuits to be equipped with supervisory signals, so that the operator is not forced to listen in to ascertain the condition of connected lines. These supervisory signals must, of course, be kept separate as to their control, at least until after the called subscriber has answered. After that both can respond to impulses from either station without impairing the efficiency of the system.

In the drawing, A and B are two connected subscribers' stations, A having called, and B not having yet responded. A's receiver should be off the hook. The signal 13 receives current from battery 14 by wire 30, line 11′, and ground. The operator, perceiving the signal, inserts the answering plug p, cutting out the annunciator 13 at the jack.

The plugs p and p′ are cross connected; that is, the sleeve of one is connected to the tip of the other, and vice versa. Bridged across the cord circuit are a pair of supervisory relays 25 and 26, and tapped off between them is the battery connection 14′. Each subscriber's circuit, when the hook is down, grounds the line on the side connected to the short spring, with which the tip of any plug makes contact. As the cords are crossed in every pair, the result of this arrangement is that when two subscribers are connected through a cord, one can close circuit from ground through one of the supervisories to ground at central, and the other through the other supervisory. Thus, the circuit from station B in the diagram would be, with hook down, from ground through bell 7, hook 6, line wire 8, spring 11, tip 19, cord conductor 18, through normally closed contacts of key 22, to relay 26, wire 14′, to battery 14 and ground. Similarly, A's circuit would be, ground 7, line 8, spring 11, tip 19 of plug p, conductor 17, to relay 25, 16, 14′, and battery 14 to ground. Note that the same side of every line is always the one to be grounded. This means that all lines must be paired, "line and mate," at the jacks, in making connection.

In examining the above circuits it becomes apparent



701,152—TELEPHONE SYSTEM.

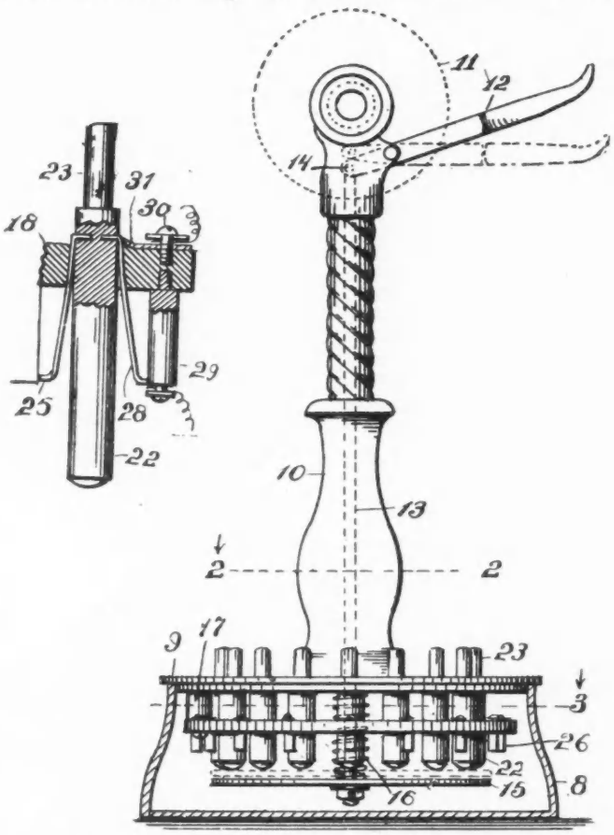
that in some cases, where the line resistances are not high, one ground at one station might operate both signals, by forming an extra circuit coming from the one station to central, then out to the other station and back by the other line conductor, and so to the second supervisory relay and to ground. For this reason it becomes necessary either to introduce resistance in all short lines, or to open the cords intermediate of the relay connections in opposite directions. Mr. Clausen does the latter. Each supervisory relay controls a local circuit 27, connected to the battery 14 on one side, and having individual branches to the relay armature

contacts, containing the lamps 23 and 24. In the circuit 27 are relays 28 and 29, each controlling a circuit closer for a break in one of the cord conductors. The breaks are shunted by condensers 40, 40, so as not to interfere with speech transmission, but no through circuit for false signals can exist; that is, each subscriber can control only his own lamp 23 or 24, until after the called subscriber has answered and the circuit is completed for conversation.

JUNE 3.

701,282—N. Bassett and W. S. Phoenix, Intercommunicating Telephone Switch.

This is a desk stand for intercommunicators, having the switch for selecting the desired line in the base. The



701,282—INTERCOMMUNICATING SWITCH.

idea is quite ingenious and is used in many places. It is or was manufactured by the Globe Telephone Manufacturing Company, of Philadelphia, Penna.

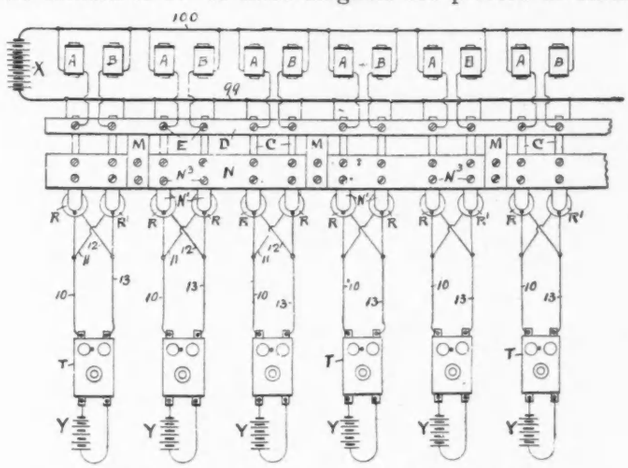
The small figure shows one button. There is a button for each line, having springs 25, 28, for the line terminals, and when pushed down these springs make contact with the posts 29, remaining in that position until restored. A plate 15 underlies all the buttons, and when the receiver is restored to the hook 12, the plate is lifted up by rod 13 attached to the hook, and any buttons that are down are thereby restored.

JUNE 3.

701,499—Nils Emel Norstrom, Automatic Telephone Exchange.

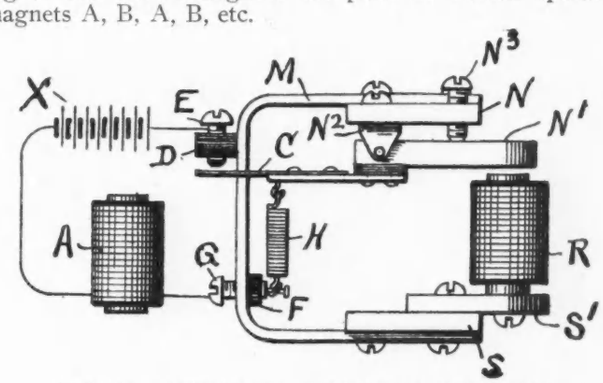
This invention relates to automatic telephone exchanges, and particularly to relay methods for their operation. In an application filed March 31, 1900, S. No. 18,519, Mr. Norstrom illustrated an automatic telephone exchange in which there is one automatic switch for each telephone in the exchange, and each switch is provided with a relay which controls the operating magnets of the switch, and in turn is controlled by the direction of impulses sent from the substation. In the present case the general arrangement is the same as in the application named, but the construction in and about the relays is somewhat modified.

In the figures herewith N and S are two long bars of magnetic material constituting pole pieces for a series of permanent magnets M, M, M, and connected between these bars are the electro-magnets R, R′ of the relays. The armatures N′ of these magnets are pivoted in blocks



701,499—AUTOMATIC TELEPHONE EXCHANGE.

secured to the upper magnet-pole bar N, and, as shown in the smaller figure, the armature contacts E, spring anchors G, as well as the magnet yokes S′, are all secured to the magnet structure. The electro-magnets R and R′ are in pairs, each pair connected in parallel, as shown, to the telephone line 10, 13, to which it belongs. Corresponding to the electro-magnets are pairs of switch operating magnets A, B, A, B, etc.



701,499—AUTOMATIC TELEPHONE EXCHANGE.

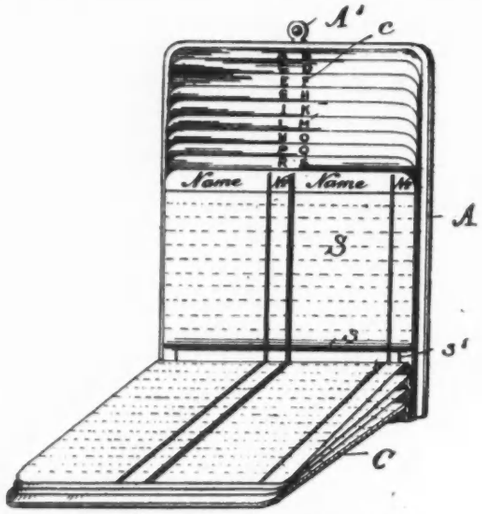
When a positive impulse is sent from any station T, by means of its local battery Y, the magnet R become properly polarized to pull down its armature, closing the circuit of its corresponding switch magnet A, but the pair magnet R′, not being properly polarized, does not close its local to magnet B; and by reversing the polarity of the impulse sent this effect can be reversed. Thus a system of polarized relays in a compact form is produced, and simplicity attained.

701,596—M. Michaelis, Telephone Call List.

This is a convenient form of telephone director, consisting of a back A having a suspension device attached to its upper end, a cover hinged to the lower end of said back, in front, at C, and covering the lower half of the same, a plurality of reference cards or sheets S carrying the names in alphabetical or other order, and arranged to be of uniformly increasing length from front to back, between the cover and back, said sheets S being evenly supported at their lower ends, so that the upper portions project in steps to expose the index letters, as shown. In using the directory the proper letter is selected and the front turned down, together with all cards in advance of said letter.

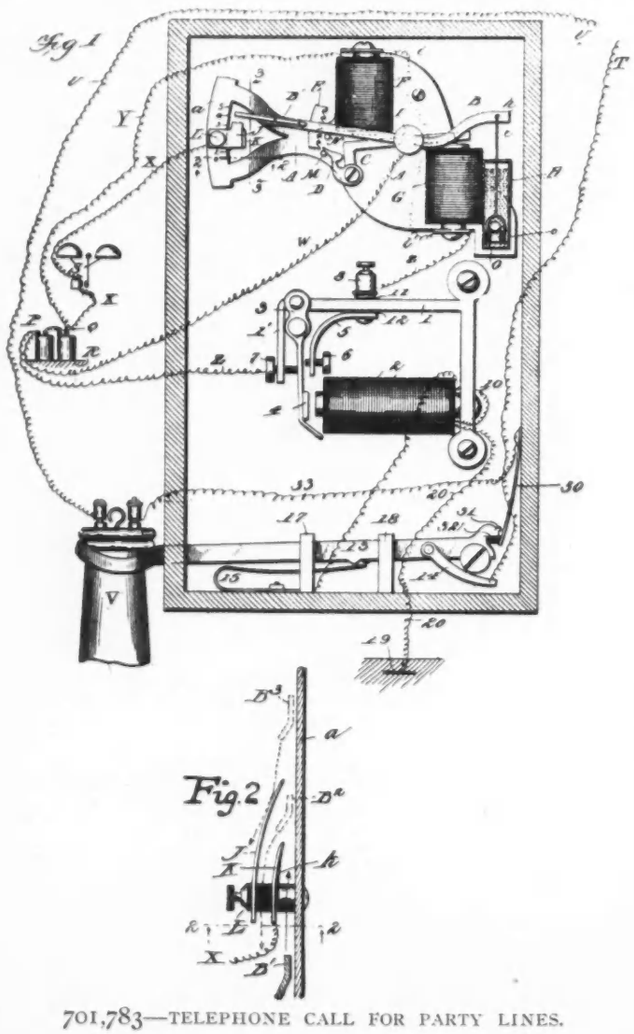
701,783—W. A. Williams, O. L. Ingram and J. B. Wilson, Telephone Call for Party Lines.

This is a step by step selective switch, closing a local bell circuit at the station wanted, and nowhere else. In



701,596—TELEPHONE CALL LIST.

figure 1 F and G are two magnets working on the same armature lever, C to tilt it and move the pawl D to step the rachet E and the circuit-closing lever B to which it is



701,783—TELEPHONE CALL FOR PARTY LINES.

attached, one step up for each impulse. One end of the lever B carries a spring contact B′, and the other carries the plunger of a dash pot H, which permits the rapid stepping up of the lever by the magnets, but retards the return. The contact B′ plays over contact plate J K, adjustably attached to an arc a. This arc is graduated with the numbers of the stations, and the position of the contact J, K varies according to the station. A relay 2 is connected to line and works the magnets F G in a local circuit.

The contact K is the active contact, while J is simply a shield. The arrangement of these contacts is really ingenious, and worthy of attention. The under contact, K, has its inner face covered with insulation k, and the overlying contact J is insulated from everything. The movable contact B′ slides under the fixed contacts, and does not touch any of them, passing under the insulation k. Its three positions for the first three pulsations are shown in Fig. 2. The full line position at the bottom is the normal one, before a call. The upper position in dotted lines is that of a station other than the one called. The middle position, beneath the contact K, is that of the station called. Here the arm B′ has stopped, and there being no more impulses it settles slowly back until it slides over the *face* of the contact K, thereby closing the bell circuit. If the upper position is the one assumed, the arm will return over the face of the guard contact J, but no circuit will be closed, because the contact J is not connected to anything. Thus no bell will be rung but the one intended. Q. E. D. (!)

701,794—C. G. Burke, Telephone System.

This is a curious system. The inventor claims to have discovered how to dispense with one line wire and with grounds. His own language is as follows: "The improvement primarily depends upon a phenomenon which occurs in the use of telephones in connection with induction coils and which may be thus described: If at the transmitting end of a telephone circuit an induction coil be employed in the usual manner, with its short primary in the local circuit of the transmitter and its long secondary in the line, a telephone receiver at the receiving end with its coil connected directly in the line will respond to the undulations of current transmitted and reproduce the speech or sounds directed into the transmitter with sufficient loudness and distinctness to answer all practical requirements of communication between points not far remote from each other, but, as is well known, the clearness of repro-

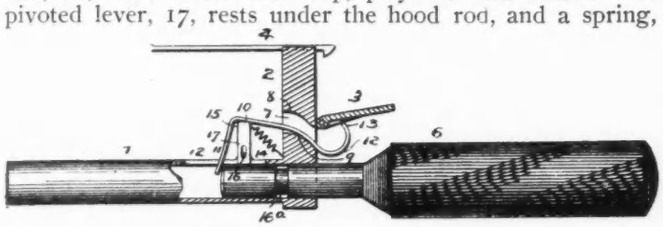
701,794—TELEPHONE SYSTEM.

duction decreases to a marked degree with the distance, and the limits of possible communication are soon reached. If, however, a second transformer or induction-coil be used at the receiving end of the circuit, its long fine-wire coil being included in the line and its short coarse-wire coil in a local circuit including a battery, and a telephone-receiver with a coil of low resistance be connected up in such local, the action of the telephone is very greatly improved, and it gives a much louder and clearer effect. I have, however, discovered that with the use of such local circuits containing both the battery and receiver I am enabled to transmit speech practically over a single ungrounded line-wire, including at each end the long fine-wire coils of the induction coils, the short coarse-wire coils of which are included in the local circuits." The figure shows such a system as Mr. Burke mentions.

JUNE 10.

702,028—J. M. Overshiner, Telephone Switchboard.

This is really an ingenious variation of the well-known "express type" combined drop and jack, the plug mechanically restoring the drop as it enters and leaves the jack. In the present case a cam-faced orifice is provided in the face plate, at 9, and a sliding hook rod 10, whose end, 12, rests under the drop, plays in said orifice. A pivoted lever, 17, rests under the hood rod, and a spring,



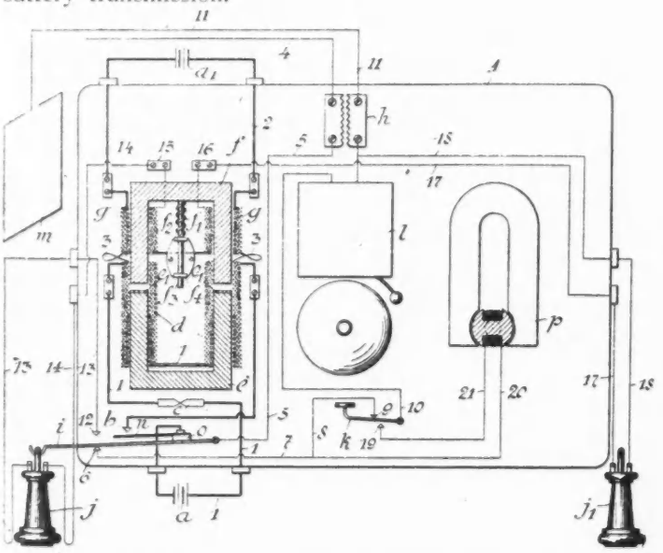
702,028—TELEPHONE SWITCHBOARD.

14, forces it normally outward. When the drop falls it rests on the hook 12, and as the plug goes in it pushes back the rod and the hook restores the drop. After the plug is all the way in the rod springs out to normal position. When the conversation of the subscriber is finished, and they have rung off, the plug is pulled out, and the lever 17, having fallen into a notch, 16a, in the plug stem, is pulled over, and again pushes back the hook rod, by means of its longer arm, 15, to restore the drop.

JUNE 17.

702,669—F. Oprendek, Sound Strengthening Appliance for Telephone Stations.

This is an alleged invention by an Austrian gentleman, who thinks it is very important to increase the efficiency of transmission from stations employing local batteries and ordinary induction coils. He has certainly not visited America, or read American literature, or he would realize that we have had for some time super-excellent local battery transmission, and that the great problem at present is the production of the same grade of common battery transmission.



702,669—SOUND-STRENGTHENING APPLIANCE FOR TELEPHONE STATIONS.

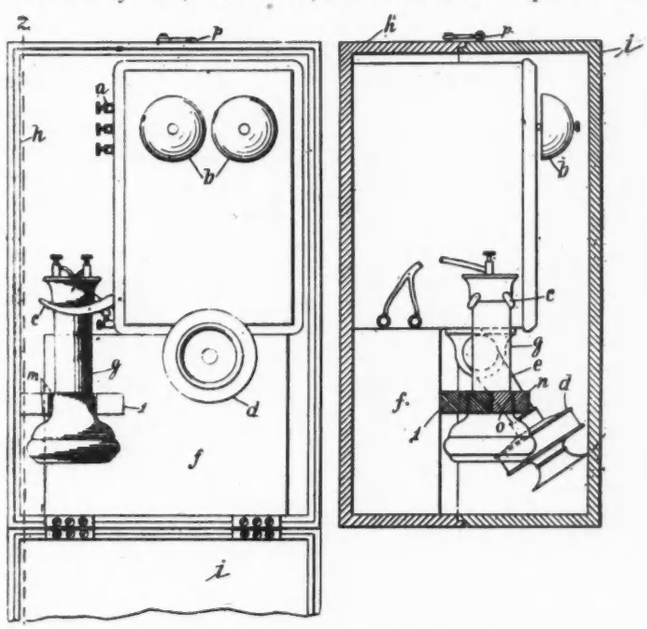
The invention consists in making the core of the induction coil solid, of soft iron, so as to constitute an ordinary magnet, and then mounting another magnet in front of it, wound with a coarse magnetizing coil in circuit with a separate battery, and with fine wires in series with the secondary of the induction coil. The gentleman states that the work done in wabbling the heavy armature (f) shown in the drawing, in consonance with the speech waves is all performed by the battery current from the extra battery (!) and so the alternating current generated is purely an addition to that produced by the transmitter, and benefits the transmission greatly.

There certainly is only one excuse for the granting of some patents. They serve to show what superfluous energy humanity has to work off—usually in the air, like exhaust steam.

JUNE 24.

703,004—L. Schmidt, Field Telephone Set.

The Mr. L. Schmidt here referred to is Mr. Lambert Schmidt, telephone manufacturer, of Weehawken, N. J. He designed the set on which this patent is based, for the Signal Corps,. U. S. A., and a good many like it are in use, in the Philippines and elsewhere with the army. The general scheme is to make a box for a telephone set that will shut up and serve as a packing box to ship the set in, and when open will become at once a handsome wall set, with battery box, backboard, and all the usual parts com-



703,004—FIELD TELEPHONE SET.

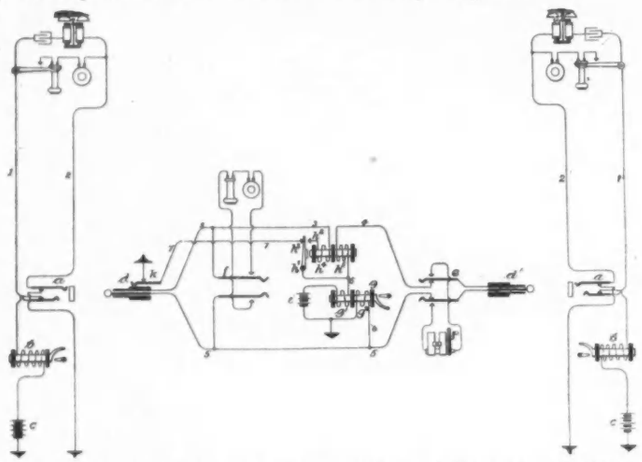
plete. In developing the idea a box or case h is provided, with a cover i, hinged to the box at the lower edge. A complete magneto bell, usually a bridging bell, with switch hook, is mounted in the box, as shown, with a small enclosure f below it for dry cells in case they are needed, as for instance, in the field, where wet cells would not be available or practicable. When the lid of the box is dropped down into the position the box and lid form a complete wall support, the lid containing the wet cells, with a cover if desired. In order to keep the receiver from moving when the box is closed and moved about in various positions, a pair of wooden clamps, l and n, are provided, the former in the box and the latter on the inside of the lid, so that when closed they clamp the receiver between them, preventing it from moving, and incidentally keeping the hook down, so as not to close the battery circuit and exhaust the batteries.

JULY 1.

12,007—Reissue, C. E. Scribner, Supervisory Signal for Telephone Switchboards.

This is a reissue of patent No. 638,426, to Mr. Scribner, dated Dec. 5, 1899. The invention relates to a supervisory signal which, until the called subscriber answers, is responsive to such answers only, but thereafter is respon-

sive to the act of either subscriber. The system is a common battery system, with source of energy at C, the subscribers' lines being shown at 1, 2, and a connecting cord circuit at 3, 4, and 5. The gist of the invention is in the arrangement of the magnets and their connections in the cord circuit. The relay h controls a break in the cord, between the contact h2 and the armature h'. The magnet of the relay has one winding h5 in the conductor 4 leading from the armature to the sleeve of calling plug d', and another winding h4 in the conductor 3 leading from the contact h2 to the sleeve of the answering plug d. Magnet g has two windings, g', g2, serially included in a bridge 6 of the cord circuit. Between the windings is connected a battery i, and one side of the battery is grounded.



12,007—SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARDS.

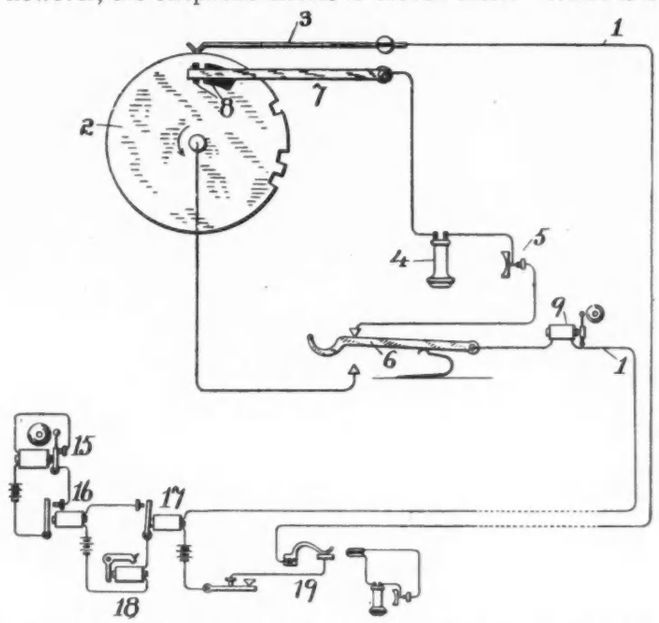
Normally the armature of the relay h is in the position shown, and the cord is open. The signal of the magnet g, however, is not displayed, because a circuit is closed at switch k in the answering plug seat, which includes battery i and one winding, g', of the magnet. When the operator answers a call the signal comes into view, because this circuit is broken. When the connection is completed the signal remains displayed until the called subscriber answers, and then retires. When he removes his receiver from the hook the following circuit is closed: Battery i, coil g', 6, coil h5, 4, d', a, 2, telephone set at subscriber's station, 1, a, d', 5, 6, coil g2, and battery. The magnets h and g are thereupon both energized. The signal is retired, and the relay h completes the cord at h' h2, so that thereafter the current from battery i can find a path to both subscribers' stations, and both must hang up their receivers before the signal will again be displayed.

JULY 8.

704,127—C. Selden, Combined District Telegraph and Telephone Signal.

It has become quite customary in some cities in this country to place telephone sets in offices and other places, in conjunction with the ordinary "messenger call boxes." These boxes are usually arranged several on the same loop or circuit, and the signals are received on a Morse register and tapper bell. When a call comes in from a box being pulled, the operator examines the tape to see what is needed, and if the distinctive signal is given for telephone the central office telephone is plugged in. The object of the present invention is to prevent the necessity of examining the tape, by giving a special audible signal when telephone is wanted.

In the drawing 2 is the usual signal wheel in the subscriber's box. When the box is "pulled" this wheel revolves, and makes and breaks contact with the spring 3 as many times as there are notches in its circumference. In the present case, the number of the box is 12, indicated by one break, a space, and two breaks. A second spring is provided forming the terminal of the telephone circuit, shown at 7, and this normally rests on the face of the wheel so as to complete the circuit. When the hook 6 is down, however, the telephone circuit is broken there. When it is

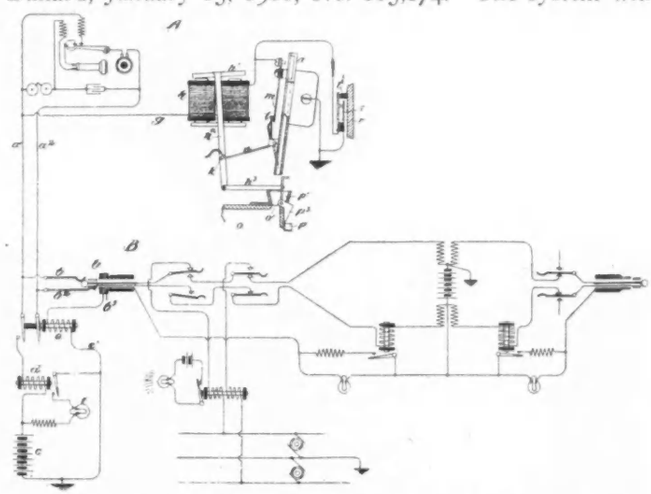


704,127—COMBINED DISTRICT TELEGRAPH AND TELEPHONE SIGNAL.

desired to call for telephonic communication with central, the receiver is taken from the hook, and the box then pulled in the usual way. The wheel then revolves, but the usual connection to the shaft from the hook 6 is broken, and the spring 7 is in circuit, this spring passing over a long space of insulation or long break in the face of the wheel, thus holding the circuit open for a longer time than usual in any regular messenger call. At the central this signal is detected by the ear on the bell 15, controlled by the relay 16, itself controlled by closed circuit relay 17 in the main circuit. A morse register 18 is also provided, as usual.

704,268—J. J. O'Connell, Coin Collector for Telephone Toll-lines.

This is an improvement on a device patented by A. M. Bullard, January 15, 1901, No. 665,874. The system with



704,268—COIN COLLECTOR FOR TELEPHONE TOLL LINES.

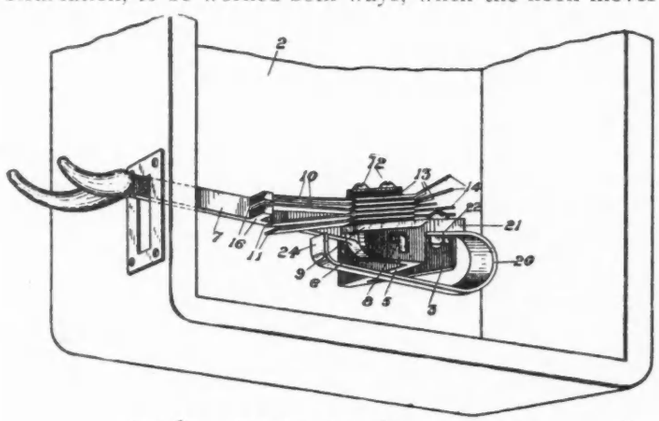
which it is employed is the usual common battery "relay type" system of the American Telegraph and Telephone Co. (Bell). A is the subscriber's station or toll station, connected to the central office B by the line wires a', a2,

and there provided with the usual line relay d, cut-off relay e, line lamp f, and connected to the main battery G, which is grounded on one side. The cord circuit has the well-known circuit and apparatus, with which we have no concern here, except that a connection is made through keys to the generators shown to throw current of either direction on the line wire a′ as desired. At the toll-station a box is provided having a chute a, with its frame grounded, and a contact spring m on one side of it, insulated from the frame, and a swinging contact l, adapted to be moved into contact with spring m when a coin is dropped in the chute. The polarized magnet h is included in the branch conductor g from the line wire a′, and connects to the spring m. When a coin is dropped in the chute the line wire a′ is grounded to call, and when the operator has determined that the desired connection is obtainable, a current is sent over the line of proper direction to throw the armature of magnet h in a clock-wise direction, to move a valve p′ to the right and permit the coin to fall out of the chute into the hopper opening o′. If the connection is not obtainable a reverse current is sent from central, and the reverse motion of the armature h′ pushes the valve p′ to the left, when the coin falls into the opening p, which leads out to the outside of the box, where it is recovered by the user of the apparatus. Heretofore, in the apparatus patented by Mr. Bullard, it was necessary to provide special shunts to prevent fluctuation of the current when the coin left the chute, because of the lack of security in the position of the contact l. In the present case, and as the gist of the invention, a cam ended lever n is provided, that rests as to its cam on the pin k on the armature lever of magnet h, so that even after the coin is out of the chute the contacts are maintained, closed mechanically.

JULY 15.

704,697—W. W. Dean, Telephone Hook Switch.

This is the well-known Kellogg Switchboard and Supply Company's switchhook, with all contacts made and broken between springs and platinum contact points. The figure needs little explanation. On the frame or standard 3 is pivoted the hook lever 7, having a projection 16, bifurcated or divided so that a spring 17 may lie in the bifurcation, to be worked both ways, when the hook moves



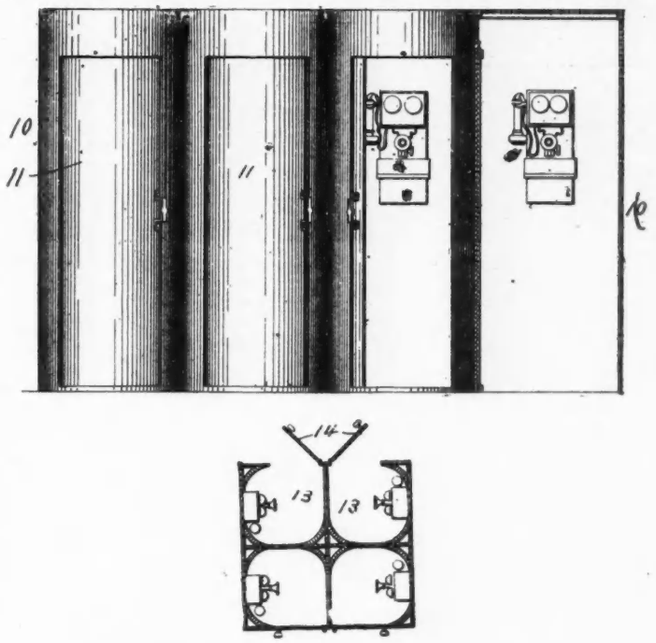
704,697—TELEPHONE HOOK SWITCH.

up and when it moves down. The lever is forced up when the receiver is removed, by the long leaf spring 20. A set of contact springs 10-11 is mounted with spring 17 on the face of the frame, in front of the lever 7, so as to be accessible and visible in all the parts. The connections are made to these springs, and their interconnection is changed as the lever moves up and down.

704,986—F. L. Tufts, Telephone Booth.

This is a telephone booth, or, rather, a set of booths, having curved walls, so as to deflect the sounds and prevent their transmission through the walls. The inventor explains his idea as follows:

My invention relates to improvements in telephone booths. In many places, and particularly in public places, it is the custom to have several of these booths in close connection, so as to accommodate several people at once who wish to use the line, and it has heretofore been found practically impossible to so construct the booths as to pre-



704,986—TELEPHONE BOOTH.

vent conversation in one booth from being heard in an adjoining booth or booths. To obviate this difficulty, great expense has been incurred in deadening walls and in making peculiarly-constructed walls; but the effort has been unsuccessful, chiefly for the reason that the sound travels in waves and flat surfaces have a sounding-board effect, so that the sound-waves are transmitted from booth to booth, and the talking in one booth is therefore heard in the next. I have discovered that the difficulty can be overcome in a very simple manner—to-wit, by making the walls of the booths curved and preferably cylindrical. By making the booths cylindrical or with curved walls the sound-waves are not only more or less deflected; but it will be observed that such a booth is braced in all directions, and instead of one wall having the sounding-board effect and vibrating to the action of sound-waves the whole structure must respond, and this being braced in all directions is not likely to occur, so that a series of booths constructed in accordance with my invention, even though comparatively thin and cheap, have the quality of preventing the transmission of sound through the walls thereof.

A MODERN TELEPHONE SYSTEM FOR VINCENNES, INDIANA.

The Kellogg Switchboard and Supply Company has recently closed a contract with the Northern Construction Company of Bryan, Ohio, for a common battery multiple switchboard for Vincennes, Ind., having 1,500 lines ultimate capacity and a framework large enough for 3,000 lines. The present equipment will contain 640 lines. The switchboard will consist of two six-panel, three-position sections. The exposed cabinet work, including the cable turning section and movable end panels, will be of selected mahogany of a dead finish. Included in this contract are 600 standard common battery wall telephones, quarter-sawed oak woodwork and concealed line binding posts; also all necessary power apparatus, main and intermediate distributing frames, relay racks and sneak current arrester equipment.

Telephony.

AN ILLUSTRATED MONTHLY TELEPHONE JOURNAL

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EDUCATING THE PUBLIC.

The American people, taken as a whole or as individuals, are very susceptible to the power of reason. They are eager to co-operate in anything promising a betterment of conditions. In this spirit lies a valuable auxiliary to the progress of Independent telephony, not heretofore fully appreciated.

The public are, speaking generally, deaf, dumb and blind to the secrets of operating a telephone exchange. When his telephone does not work satisfactorily, the subscriber blames the girl at central. He accuses her of willfully cutting him off, blames her if the man he wants does not answer his call, and if it chances that an immediate response to his signal to central is not given, he grows sarcastic in his reference to the indolence of the operator.

It is idle to hope for too much from the telephone public, but the fact that the nervous strain of operating switchboards drives many operators to the verge of nervous prostration ought to evidence the fact that some degree of reform is possible. It would be an excellent idea for the exchange operators to consider, anyhow.

A bright, well-worded paragraph, on a card conspicuously placed on every telephone, would do much to mitigate this evil. A little booklet of instructions to telephone users, or, better still, a system of instructions, would increase by much more than the cost the efficiency of telephone service and would do much to remove the friction and unpleasantness which have to-day made enemies of the public and the much abused Hello girl, who gets all the blame.

INDEPENDENT TOLL LINES.

The subject of Independent toll lines is daily engrossing more and more attention. It has grown in importance chiefly by reason of the impetus given to toll line traffic by the Independent movement. Independent telephone men are therefore in the anomalous predicament of having practically created a demand which their present facilities will not enable them to fill. When it is realized that the demand for toll line service is a new public appetite, fostered almost entirely by the Independent movement, it is evident, logically, that the responsibility for satisfying the demand created by them must rest on the Independents. This conclusion, pursued to its logical result, should in itself be a sufficient argument against any plan contemplating Bell control of Independent toll line connections. The situation to be confronted is, therefore, not one of choice between Bell and Independent, but of different Independent methods of accomplishing the same result.

There have been evolved from actual experience and observation of actual conditions two answers to the Independent toll line problem. These two answers or methods of procedure have been practically demonstrated, on a limited scale, in various parts of the country. One of these methods will survive the other; it is extremely probable that one will succeed the other in natural sequence.

Independent toll lines are being built in some parts of the United States by the local exchange companies, who have thus woven their separate lines into one complete whole, the ownership of which has, however, remained divided among the local exchanges interested.

The second method has been that of building long toll lines by a company organized purely for toll line business, owning all the lines and making contracts or leases with exchange companies along its right of way.

Much is to be said in favor of either plan.

In behalf of the local or community ownership idea, it is claimed especially that it is the only method by which present needs can be supplied. Individual exchanges are not willing to wait until a large, toll line company can finance and build its lines to them. The need of traffic arrangements with their neighboring exchanges is pressing and immediate. To this argument in favor of the building of local toll lines there appears to be no present answer. Financiers, while rapidly learning, have not yet fully mastered the lesson of Independent telephone possibilities. Vigorous in its growth, the Independent movement will brook no constraint of conventional methods. If Independents cannot get assistance from others, they proceed to do things themselves. This spirit is inherent in the business itself.

There can be no denial of the fact, on the other hand,

that uniformly, well-built and properly managed toll lines, centralized in ownership and policy, would be infinitely preferable to a multiplied and complex combination of local lines. Beautiful in theory as such a condition appears, it is a practical impossibility at the present time. It is a condition, not a theory, which confronts us.

It is unnecessary, to enumerate the minor arguments in favor of either method. The fact that the local idea gives present relief, while the centralized does not, answers conclusively the question for most Independents. The arguments against each plan, considered separately, have resolved themselves into about the same classification, with the addition that it is charged that selfish human nature will on the one hand defeat the local plan, by reason of the practical impossibility of fixing a satisfactory division or scale of toll line charges, while on the other hand a centralized control of toll line traffic might be a temptation to monopoly ideas, and hence defeat the very end sought to be accomplished in the Independent fight.

For the future, some concerted plan should be made and carried out. On the one hand, there cannot permanently be an unlimited multiplication of hybrid lines, some well and some poorly built, and on the other there must be a guarantee against the creation of a new dangerous and all-powerful monopoly.

While not pretending to profess ability to solve a problem which has taxed the genius of the best engineers, TELEPHONY proffers the opinion that the fundamental remedy for existing difficulties lies simply in the standardizing of toll line construction on specifications fixed by a congress of engineers and exchange men and enforced by the prestige of a national organizaiton created for that purpose. A chain is no stronger than its weakest link, and so must toll line traffic depend for its success on the construction and maintenance of every mile of line traversed by the messages sent. The American form of government is a centralization of the local ideas of self government on republican lines. Its similarity to the ideal system of telephone toll lines is marked. Just as the local town or city governments are on a practically uniform basis, corresponding on a small scale to the larger governmental systems of the states and nation, so must a system of toll lines, designed to serve the same people as the local, state and national governments serve, be designed to have a uniformity of the systems both local and general, so that the inherent parts of both are the same.

Uniformity of local plans with one general plan will result in quick and easy conversion of local toll lines to general use. It will make all work accomplished, so much done toward completion and will not necessitate reconstruction, with a total loss of old equipment, when the local lines become links in the general chain.

System in building appears to be the first element of ultimate success. It may mean more expense to begin with, but it means a great saving in the end. The future toll line companies will prefer to purchase outright, at a fair and even liberal price, the lines adapted to their purposes in preference to building new lines of their own. It is easier to finance a property already in operation and paying good profits than it is to get the money for a mere prospective enterprise.

TELEPHONY believes that the only way to solve this problem is to work it out. Theories and generalities count for nothing. Toll lines are needed *now*, and are being built *to-day*. Why not build them so that when complete they can serve a larger purpose in the Independent movement.

The various state, interstate and national associations would do well to look into this matter on this "line of least resistance" and see if the remedy is not in the simple adherence to uniformity in telephone construction.

Meanwhile, local Independent toll line arrangements must be governed by a spirit of mutual concession and forbearance, together with a willingness of all parties concerned to be fair with one another, both in division of expense and profits.

THE (MICHIGAN) BELL'S DILEMMA.

In the July TELEPHONY it was announced that the Michigan Telephone Company would default in the payment of interest on its bonds. This has put a different aspect on the matter of Bell securities, which heretofore have been considered desirable investments. It has been pointed out that the Bell licensee companies could not meet the interest on their bonds and pay dividends on watered stock in the face of stiff competition. The president of the American Telephone and Telegraph Company in his last annual report acknowledges that the Independents have made much progress and have affected the earnings of the licensee companies to a considerable extent. It was not generally thought, however, that the Independents should so cripple a Bell licensee that it would have to default in the payment of interest on its bonds. This default has brought before the public, especially in Detroit, a very important point, although well understood by "insiders." It is the matter of the old Detroit Telephone Company franchise.

The Wayne Circuit court has decided that the Michigan company is bound to furnish Detroit telephone service at the rates provided by that company's franchise on demand.

The Detroit company's plant was absorbed and dismantled long ago, but a few subscribers insist on keeping their contracts at the old prices—$24 and $36 a year.

Judge Carpenter's decision has been appealed to the Supreme court, and lawyers say it will undoubtedly be affirmed. The Michigan Telephone Company would then be put in a very unpleasant position. It would be obliged to come down to the old rates, for everybody would demand a Detroit telephone, and the Michigan company would have to furnish its present service at $24 and $36.

It looks very much as though the Michigan Bell is in a very uncomfortable position, the only feasible outcome of which seems to be the company's dissolution.

THE TELEGRAPHONE.

Our readers will remember the beautiful electromagnetic phonograph, known as the Poulsen telegraphone, which excited so much interest and admiration at the Paris Exhibition of 1900, says a foreign exchange. The record is made on a steel wire or ribbon by the alteration of its internal magnetization by the passage over it of an electromagnet in connection with a telephone transmitter into which the message is spoken, so that the instrument may be set up in an office to receive and record telephone messages in the absence of a clerk, or to receive confidential messages for a principal, remaining locked up in his desk until he returns and reads them off by connecting the instrument with his telephone receiver. Herr Pedersen, of Copenhagen, has recently obtained a patent for a very important improvement in this instrument, making it possible to read a number of messages on a single steel wire or strip, and to reproduce each message without interference from the other, thereby materially lessening the size of the drum and the length of wire or ribbon required. This addition will considerably increase the practical utility of this instrument.

TELEPHONY:

Inclosed please find $1.00 for renewal subscription to TELEPHONY. Would feel lost without it. I began with number one and consider it strictly up to date.

CHAS. W. BOLLINGER,

The Magic Telephone.

The village of Wauseon, Ohio, had reached the conclusion that it wanted telephone service. A number of business men in the place formulated a petition, addressed to the Central Union Telephone Company, which controls the Bell rights for that part of Ohio. In due time there came a communication from the main office at Chicago, refusing the application. Wauseon, with less than three thousand people, the telephone company said, was entirely too small to warrant the installation of a plant. This was in the spring of 1895.

What followed sounds like a romance. A campaign of competition was inaugurated that has revolutionized the telephone situation in the United States.

The leader in the movement for telephone service in Wauseon was Edward L. Barber, a young man of thirty-three, head of a private banking institution inherited from his father. He was a graduate of Cornell, had lived for a few years in Cleveland, but for ten years he had been back in Wauseon, his birthplace. One of Mr. Barber's closest friends was James S. Brailey, Jr., who was born in Wauseon twenty-three years before. He had attended the Northwestern College, and from there had gone to the University of Cincinnati and the Ohio State University, graduating as a lawyer in 1894. He had just about settled down to practice his profession in his native place when the Bell people made the foolish mistake of denying Wauseon. But for this mistake Mr. Brailey would, in all human probability, be a country lawyer to-day, looking after a comfortable but limited practice, and Mr. Barber would be a country banker as his father had been before him. Instead, these young men are the controlling factors in forty-six telephone companies and a few years will see them millionaires several times over. They have inaugurated telephone systems, larger than the Bell, in Louisville and Lexington, Kansas City, Toledo, Utica, and some forty other places of lesser importance. Their systems are valued at many millions, and they are only at the beginning of their careers. And all this grew out of the Bell people's refusal to accommodate Wauseon. The act aroused Mr. Barber's ire. He hunted up his friend Brailey and laid the case before him.

"Now," said he, "can't we compel these people to give us service?"

"No," said young Brailey, "we can't. But I'll tell you what we can do. We can get together with the other business men here and install our own system."

"But how about the patents on the telephones?"

"They expired last year. The Bell people assert they are still protected in their monopoly by the Berliner patent, but I am sure that will not hold water. There are already plenty of people in the field who are making telephones, and who will be only too glad to supply us with instruments. If they can afford to take the chance, we certainly can."

The two young men associated themselves then and there for the purpose of building a telephone system for the village. They didn't know anything about the business, but that didn't deter them in the least. They set to work to learn. Some other young men in the town were interested in the proposition, and one fine morning there was a central in Wauseon. There were only sixty subscribers; to-day there are four hundred and more, or one for every seven man, woman and child in the place. At this time neither Barber nor Brailey had any idea of going into telephone construction. But it happened that the neighboring towns of Napoleon, Ohio, and Adrian, Michigan, seeing how smoothly the telephone scheme worked in Wauseon, determined to have a similar service. Messrs. Barber and Brailey were requested to do the construction work. This was the real inception of the firm. The profit in Napoleon and Adrian was small, but it opened the eyes of the two young men to the possibilities that lay in this line of work. They organized the Central Construction Company, a partnership concern in which they hold equal shares, and went regularly into the installation of Independent telephone systems. They worked all through Northern and Central Ohio, and then branched out into Indiana, New York, and afterward into Kentucky, until to-day their interests extend into many of the principal states.

In this connection it is interesting to note that practically all the people who are engaged in Independent telephone construction to-day were novices, men without training who drifted into the industry through circumstances. The Independent field is so new and the development has been so enormous, that it has been wholly impossible to pick up in sufficient numbers men who have been regularly trained for the business. There is no other work in the United States that offers such prospects for bright, energetic, pushing young men who are looking about for business openings. I doubt whether any one not actively engaged realizes what has been going on in the telephone industry during the past seven years and what may be expected in the next seven. We have only so recently emerged from the absolute domination of the Bell companies that the general public is not yet awake to the fact that there is such a thing as a first-class telephone service outside of Bell control. This is true particularly in the East, where Independent telephony is just beginning to develop. It will probably be news, therefore, to the public, that on the first of May there were in use in this country, in round numbers, three million four hundred thousand telephones. Of these only one million four hundred thousand were controlled by the American Bell Telephone Company, as against two million and over controlled by the Independent companies. This is not mere guesswork. The figures have been carefully compiled. They are not absolutely accurate, simply because it is impossible to keep up with development in the Independent field. Figures that are official to-day are dead to-morrow. Independent companies are springing up over night, and almost without exception they are successful from the very start. It is of record that there were more failures of national banks last year than of Independent telephone companies of the last three years. Yet a dozen telephone companies are organized where one national bank is organized. And we have always been accustomed to look on a national bank as the soundest institution in the country. It is difficult, even with figures, to give an adequate idea of the telephone situation. In 1894, there were less than three hundred thousand telephones in use throughout the country. Three million new telephones, in round numbers, have been put in service in the last seven years, or ten times as many as had been installed during the preceding eighteen years. If this ratio of increase is to continue we shall have over fifteen million telephones in use in 1920. There are plenty of people qualified to pass an opinion who put it down that we shall have a great many more.

In discussing telephony, even the best informed people will often make the mistake of underestimating the strength of the new movement. They will tell you that the Independents are all right in the country and in small towns, but that they will never be factors in the large cities where the Bell people have from the start been firmly intrenched. The facts do not bear this out. To-day Independent companies are operating in St. Louis, Baltimore, Cleveland, Pittsburg, Newark, Louisville, Minneapolis, Indianapolis, St. Paul, Rochester, Toledo, and so on down the list. In Philadelphia an Independent company has about completed its plant, and is already giving a partial service. Buffalo, Detroit and Kansas City are building. Thus of the first twenty-six American cities, fifteen have Independent services and in the others prospects are promising. It is a question of time, and a very short time, I believe, when the situ-

ation will be cleared up in New York and Boston and the Bell people will meet with competition in these two cities. Chicago gave a franchise some time ago to a company which is at present constructing conduits for its cables. San Francisco has granted a franchise, and an Independent company is now in the field seeking a grant for Cincinnati. New Orleans had an Independent company until recently, when the Bell people bought it out at a fancy figure. Applications for telephone rights are pending in Milwaukee and Washington. Of the seventy-four lesser cities having a population of between thirty-eight thousand and one hundred and thirty thousand, fifty-two have Independent exchanges, and franchises are now being actively sought in a majority of the remaining twenty-two.

In the past it has been the policy of the Bell Company to buy up its rivals when they showed signs of becoming formidable. But experience has shown the unwisdom of this course, for no sooner has one company been put out of business by purchase than another has sprung up. In New Orleans, for example,where a big price was paid for the control of the Independent company that had been built up there, a company of important capitalists is now organizing a new Independent concern. Detroit was bought out, but a new plant is now under way. The Bell people have, therefore, practically abandoned the practice of purchasing and are meeting competition by cutting rates and improving service, a state of affairs that is bringing great joy to their subscribers.

Since 1895 more than two hundred thousand instruments have been put into farmhouses. The farmers of the Middle West have been particularly progressive. Farmers 'exchanges have sprung up everywhere in Ohio, Indiana, Michigan and the neighboring states. The manner in which these exchanges go up is well illustrated by what are now known as the Stafford lines, in Geauga County, Ohio. In the spring of 1896 a number of farmers living about five miles east of Chagrin Falls, which is on the western border of Geauga County, concluded that it would be a pretty good thing to get into closer touch with each other by installing a telephone line running from house to house. They cut and set their own poles and here and there the fences were used to run wires. There were not over half a dozen in the original combination. The results were so satisfactory that the news spread in the neighborhood, and by fall several others concluded to build a line, using, with some extensions, the poles already erected. Up to this time it was simply possible under this scheme to talk from one house to the other. But as the number grew it was finally decided that it would be a good scheme if they could exchange conversations. One of the farmers, George W. Stafford, volunteered the use of his house as a "central" and here a switchboard was installed. Pretty soon the families in the neighborhood were fairly clamoring for connection, and as the exchange business grew Mr. Stafford realized that it would take some one's entire time to look after it. He therefore made a proposition to his neighbors to handle the exchange on a business basis. To-day this exchange, which is five or six miles away from the nearest railroad and which stands about a half mile from its nearest neighbor, controls forty-five miles of pole lines and has a hundred and fifty subscribers paying twelve dollars a year. It has a modern switchboard and its list of instruments is growing every day. It has long-distance connection with Cleveland, Painsville, Ashtabula, Warren, Youngstown and other centers of population, besides giving free service throughout the entire county of Geauga.

A telephone promoter is welcomed in rural communities with more eagerness than Santa Claus. An excellent example, though by no means an exceptional one, of what may be done, is furnished by the experience of a newspaper editor at Sturgeon, Missouri. He had a country weekly, and in order to get in closer touch with his people for stock and crop reports he concluded to build a little telephone line out through a certain section, where he could tap a number of houses. His neighbors laughed at him as a scatterbrain who didn't know what to do with his money, but he kept on building. To-day he is making more money out of his telephone line than he is out of his paper, and he is extending the system in all directions.

At Tipton, Indiana, a place of thirty-eight hundred population, forty miles from Indianapolis, there is an exchange manager who is going through the same process, only reversed. From a telephone man he is rapidly going into the field of an editor. He has a number of farm lines running out along the roads that lead to Tipton. With few exceptions, the houses along these roads are connected. The Indianapolis evening papers get into Tipton shortly after supper. The telephone man takes these papers, clips the headlines bearing on the main features, prepares a short synopsis, carefully written out, and pastes up what is known among newspaper men as a "dummy." When this is finished at a certain hour every evening he connects with all his lines, and gives a prescribed number of rings that brings every subscriber to his telephone. Then the exchange manager proceeds to read to the farmers his summary of the latest news. This is followed by stock reports, weather probabilities and other special information that is certain to interest subscribers all along the line. At the other end the news is received by some member of the household, who repeats it aloud to the other members of the family gathered about the telephone. In this way the farmers know the chief happenings of the world almost as soon as they appear on the bulletin boards of the newspapers in the great metropolitan centers. This system, original with Tipton, has spread all through the Middle West and is now general in every farming community.

It is this sort of growth in entirely new fields that has brought all sorts and conditions of people into telephony. Doctors, lawyers, ministers, politicians, butchers, bakers, blacksmiths are all to be actively found promoting, building, operating. Sometimes mere children, boys of seventeen and eighteen, will be found in little stations in out-of-the-way localities. In El Paso, Texas, there is a company of which a woman, Mrs. Brett, is president. Her husband was a telephone contractor, and had built up a prosperous business when he died. She bravely took up the work and has succeeded spendidly. She operates several companies herself and in addition does general construction work. She has built up an excellent business reputation throughout the West and has all the contracts she can handle.

In Newton, New Jersey, Dr. H. A. Miller had built up a considerable practice. Ill-health forced him to retire. He became interested in telephony and in order to employ his leisure time built a little line in and about Newton. To-day he has two hundred subscribers, an exchange that is equipped with all the modern appliances, and is making over eight per cent on the money invested.

Instances such as these could be multiplied by the score. People who have taken up telephony as a pastime or as a side issue have invariably ended by becoming fascinated by it and giving it their entire time. Many of these have started practically without capital, most of them without experience.

When the telephone field was thrown open to all comers in 1894 there was no one in the field except employes or ex-employes of the Bell Company who had any knowledge of the subject. The Bell people from the start had impressed a policy of silence. No officer, engineer or manager of any company was allowed to write on the subject of telephony or to give to the public any information. For such literature as there was this country had to depend upon Europe. Now and then if a Bell man ventured into print, either through technical journals or otherwise, he was promptly taken to task and advised that a further transgres-

sion would result in trouble. When the break came, however, at the expiration of the patents, a number of writers appeared in the field, and to-day we have excellent textbooks, including American Telephone Practice, by Kempster B. Miller; The Telephone Hand-Book, by Herbert Laws Webb; Practical Features of Telephone Work, by A. E. Dobbs, and The A B C of the Telephone, by J. E. Homans. There are also one weekly and two monthly telephone journals in the field, and all the important electrical papers devote special departments to the work. It was generally the policy of the old company to buy up all the telephone patents and shelve them. This naturally retarded improvements, and the United States up to 1894 was far behind some of the other countries in its appliances, though it was the home of the telephone. In Sweden, for example, where the Bell company had never been able to obtain a monopoly and where the field was open to all comers, the mechanism of telephony was far ahead of the United States, and to this day the use of the telephone is much more general there than it is here, though we are rapidly catching up. When the Independents came into the field all this was changed, and to-day we are producing a higher grade of instrument than is to be found anywhere else in the world.

Under the leases granted by the Bell company for territorial rights all instruments have had to be rented from the parent company, and all switchboards and central office apparatus must be purchased from the Western Electric Company, a manufacturing concern controlled by the parent company. As soon as the field was thrown open a host of the Independent manufacturers started up and their growth has been phenomenal. Their factories employ thousands upon thousands of men and represent the investment of many millions of capital. All this since 1895.

A volume could be written about the rise of this manufacturing branch of the Independent telephone industry. A few examples that have come under my own observation will give an indication of what has taken place.

A few years ago two emigrants landed in Chicago. They were unable to speak English, but having had a little experience in their native land they got positions with the Chicago Telephone Company as repairmen at a dollar and a half a day. They were hard workers and ambitious. They set themselves to learn English and put in their spare hours studying the mechanism of the telephone. In 1895 they had a few hundred dollars saved between them. They resigned their positions and opened a little workroom where they began to make telephone instruments. Their working force, besides themselves, consisted of two men and three boys. They were threatened with infringement suits and all manner of pressure was brought to bear to force them out of business. But they hung on. A few weeks ago one of these men took me over the factory he and his partner had built up out of that little workroom. There I saw a plant that occupied half a city block and employed twelve hundred people. They were turning out a complete telephone every minute. Recently these two manufacturers reorganized their company and now they are about to add fifty per cent to their facilities, and still they doubt their ability to keep up to their orders, though with their new force they will ultimately be able to turn out close to a thousand telephones a day.

Another well-known manufacturer who has an enormous plant was a boy operator for the Bell company. When the Independent field was opened he branched out in a small way for himself. To-day he is president of a big corporation that makes telephones by the hundred thousand.—William Henry McDonough, in the Saturday Evening Post.

I consider TELEPHONY the best telephone journal in the field. HARRY S. COYLE.

APPLICATION OF THE MODERN TELEPHONE.

In considering the various phases of city life in this twentieth century, several things stand out with striking prominence from the curiously jumbled background of which they form an integral part, says the Electrical Age. We are essentially a busy people. No other nation can grasp fully the swing and the stride of our giant enterprise, because they lack the first principle of such understanding, a true concept of what a "day's work" means tc an American business man. Even Germany, our most aggressive competitor, seems unable to put into ten hours much more than a half or three-quarters as much as we can put in them. And so we prosper and forge ahead.

Of all the influences at work to-day for promoting ease and luxury, electricity, with particular reference to its applications in railway, telephone and telegraph matters, stands easily foremost. And of the three, the telephone is the most powerful. To its distance-annihilating magic may be credited the existence of many great and powerful businesses. It has come to be an important if not almost a vital factor in the cities' home life. Its active place in the daily routine could not be replaced by any other instrument of like size and practical utility. In New York city alone there are eighty thousand stations under the control of one company, and perhaps a fourth of these are situated in other than places of business.

Manhattan Island is divided by the local telephone company into precincts or districts with a central station in each. Turning to the familiar Cortlandt exchange or central station, let us consider what would happen if, for the brief space of one day, it were cut out and could give absolutely no service. Practically all the "snap-shot" financial business of the city would be at a dead stop within ten minutes. Then the ticket offices and express companies would feel the paralysis stealing rapidly over them with numbing force and restless impulse. Frantic brokers, unable to get advices, would weep and laugh hysterically, curse, tear up to the telegraph instruments—and find the hastily scrawled notice posted above them: "Owing to pressure of business, no rush messages will be accepted." Then the newspapers would feel the icy grip of silence, and next morning four pages would appear where there formerly were fourteen.

And if the exchange named, or, for the sake of argument, all the instruments below the City Hall, should be cut out or in some other way put out of business, the matter would become one of the gravest moment. Suppose such a case: how is the volume of business now transacted by telephone to be done? Must the tenant in a twenty-seventh-story office in the great Syndicate building come out and walk down to Bowling Green to talk to a customer on the twentieth floor of that sky-scraper? He will send a messenger, is the reply. Very well; would he? Taking three of the large office buildings below City Hall as averaging ten thousand calls apiece daily, divided equally between incoming and outgoing messages, and figuring an average of approximately one hundred and fifty thousand calls a day for the district named, and we have a basis on which to consider the justly famous A. T. D. boy, the leaden-footen Mercury without wings. Each of the three large buildings has ten elevators. The average number of trips per hour is about fifteen, a round trip being made in four minutes, and the passengers carried five. This gives a total of about twenty-four thousand passengers carried a day under normal conditions. Each building also has about ten thousand telephone calls per day. Accordingly, should that efficient instrument, the telephone, be cut off, the elevator service would have to be considerably more than doubled. Fifteen thousand incoming boys and fifteen thousand outgoing boys in three buildings! They could not get into the buildings, or, if in them, they could not get out. Side streets would

choke up, traffic in the usual highways and byways of commerce would cease, giving place to the blue-coated army. Tremendous inconvenience and even great financial loss would result—but how the Italian push-cart men would profit!

Going a trifle farther into the matter we may consider, leaving the question of elevator capacity out of the issue, the one hundred and fifty thousand calls a day for the entire district. There are not one hundred and fifty thousand boys in New York to-day available for messenger work, but supposing that there were, they would make a carpet for all of Broadway from the new site for the custom house to about Astor place. Strung out so that one lad's outstretched fingers touched the heels of the one before him, and allowing each one a total length, thus placed, of five feet six inches, the vast army, bigger than the combined forces of the Confederacy and the Union at the famous battle of Gettysburg by several thousand, would reach from the Grand Central Station in New York city to a point three miles north of Albany. Marching in columns of fours, as in usual parades, it would take the boys—provided they marched at regular speed, made no stops, and had no distracting novels to worry them—about fifteen hours to pass a given point. But if they were allowed to run loose in Broadway without let or hindrance during the working hours of a business day, traffic of all kinds would be instantly ended. Street cars, cabs, vehicles of all sorts, general pedestrians and everything else would be stopped by the seething jumble of the boys in blue, who themselves would be unable to do more than move a foot an hour, if so much. Not only in Broadway would this be true, but in the side streets also.

Should such a telephoneless condition ever eventuate—and we may well hope it never will—the whole nature of public and private life would be totally changed in a miraculously short space of time. It is true that though the telephone eases business pressure and makes life better worth the living for all of us, it also creates pressure and causes conditions of life peculiarly its own, for where there is no telephone there is no rush. Northern China, for instance, is not in a hurry, is never very weary and always ready to put off duty. Much of Mexico jokes with to-morrow and blarneys to-day, smoking the inconsequent cigarette of blissful idleness and calm indifference to mere trite conventionality in the shape of work, and these peoples, in their ignorance, smile in contemptuous good humor at the innocent little instrument that enables us to cram forty-eight hours' work into ten, and go home at night too tired to eat or sleep with comfort. A telephoneless Arcady may be delightful, but it is not *au fait* in America or its metropolis.

Generally panicky conditions in the stock markets, spasmodic jumps in the prices of food, heavy profits for shoemakers, the probable loss of millions of dollars to the newspapers, a vast army of former employes out of work and desperate a quadrupling of the present heavy city and local mails, still more congestion of traffic on the Brooklyn bridge and the various ferries than now exists, and the rapid fall of rents in the lofty office buildings would be the consequences of partial telephone paralysis in New York city. And "yellow journalism" would be impossible.

It will be seen from this somewhat fantastic sketch that the sky-scraper exists only by aid of the telephone. Rapid-fire business has become so large a part of our commercial life, during the past ten years, that to men engaged in it the telephone is an imperative necessity. Having also to be within easy striking distance of certain definite points, like the banks and exchanges, better accommodations were demanded. These are the conditions that led to the erection of such buildings as the Park Row or Syndicate, Broad-Exchange and many others which, without the telephone, would be as impossible as it is to enjoy a trip in the trolley across "the bridge" during rush hours.

As a prominent engineer said to the writer recently: "Oh, yes, I know. Telephone's a great thing. But how much devilment can be charged to it?"

TRADE NOTES.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, manufacturer of telephones, switchboards and accessories, has moved its offices and factory to No. 336 Ellicott Square, Buffalo, N. Y. The company has adequate facilities for properly recognizing any order demanding the most severe requirements.

MR. JOHN DONNELLY, Branfort, Ct., is the sole maker of the well-known Donnelly climbers for linemen. These climbers can be respurred, the two spurs being mailed by the maker at a small nominal cost. As Mr. Donnelly will hereafter sell these climbers direct to the trade—they being formerly handled by Mr. J. J. Redy of New Haven—all enquiries will be sent to John Donnelly, at Branfort, Ct.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, Chicago, has gotten out a neat little paper weight that will be appreciated by those who are fortunate enough to receive one. It consists of a brass disk two inches in diameter, at the center of which is a miniature representation (also of brass) of a spool of tested fused wire. This is intended for a handle to lift the weight by.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is just out with one of the handsomest, most comprehensive and best arranged electrical supply catalogues ever sent to the trade. This is its No. 16 and is accompanied by its up-to-date loose leaf net price list and discount sheet. It is so arranged that as prices change new leaves may be inserted. The compilation is a distinct advance over previous issues and is certain to meet with favor by buyers and users of electrical goods.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has secured a contract for 6,000 telephone sets. This order was placed as the result of a competitive telephone test at Scranton, Pa., of 400 miles over a long-distance line, conducted by Wilbur H. Johnston, chief engineer of the Frontier Telephone Company, Buffalo, N. Y. The company claims that the Kellogg transmitters have been tested on lines up to 1,500 miles and found to be perfectly satisfactory.

THE UNITED STATES ELECTRIC MANUFACTURING COMPANY, Butler, Pa., is sending out a complete and up-to-date catalogue of switchboards, series and bridging telephones, desk sets, extension bells, testing sets, etc.; also describing in detail the company's electric ideal, automatic system for farmer's lines and small towns, and its ideal selective lockout party line system for exchange services. The catalogue is fully ilustrated and contains a number of valuable diagrams and suggestions. This catalogue will be sent postpaid to any address upon request.

THE STANDARD TELEPHONE & ELECTRIC COMPANY, Madison, Wis., report that business is unusually large with the company. Orders for switchboards and telephones, the past month have been good. The new improved "Standard switchboard," with combined drops and jacks, automatic self-restoring shutters, and new type of ringing and listening keys, will be ready for delivering July 15th. Several orders have already been booked for the new style of switchboard and the indications are that the new board will have a large sale. The "Standard" is also making a specialty of furnishing telephones for selective work and for toll and farmer's lines.

THE HARVARD ELECTRIC COMPANY.

The Harvard Electric Company, 224-226 South Clinton street, Chicago, has had a rapid growth since the company was started some four years ago. The company commenced business January 27, 1898, having desk room at 52 Dearborn street, Chicago, and the first product was made by one man. The sale of fuses at that time were not enough to keep this one man busy. However, the business increased and larger quarters were secured. It continued to grow and again more space was necessary, until finally the company secured its present commodious factory at 224-226 South Clinton street, where many improvements have been made in the company's line of protective devices.

FREDERIC GREER.

The company was incorporated June 18, 1898, for $2,500, under the laws of the state of Illinois. Later it was increased to $10,000 to properly care for the company's rapidly growing business. Only recently it was found necessary to increase the capital stock to $50,000.

The company now has on the market a complete line of fuses, fusible cut-outs, carbon lightning arresters, distributing boards, heat coils, terminals, etc., for the complete protection of telephones, switchboards, telegraph instruments and other sensitive apparatus.

In order to further assure the accuracy of its protectors the Harvard Electric Company added a fuse wire department to its factory and the product is known as "Green" tested fuse wire, fuse strips, links, etc., which are well known in the telephone and electric field.

The company attributes its success to the fact that it has always tried to furnish the best goods at the lowest prices.

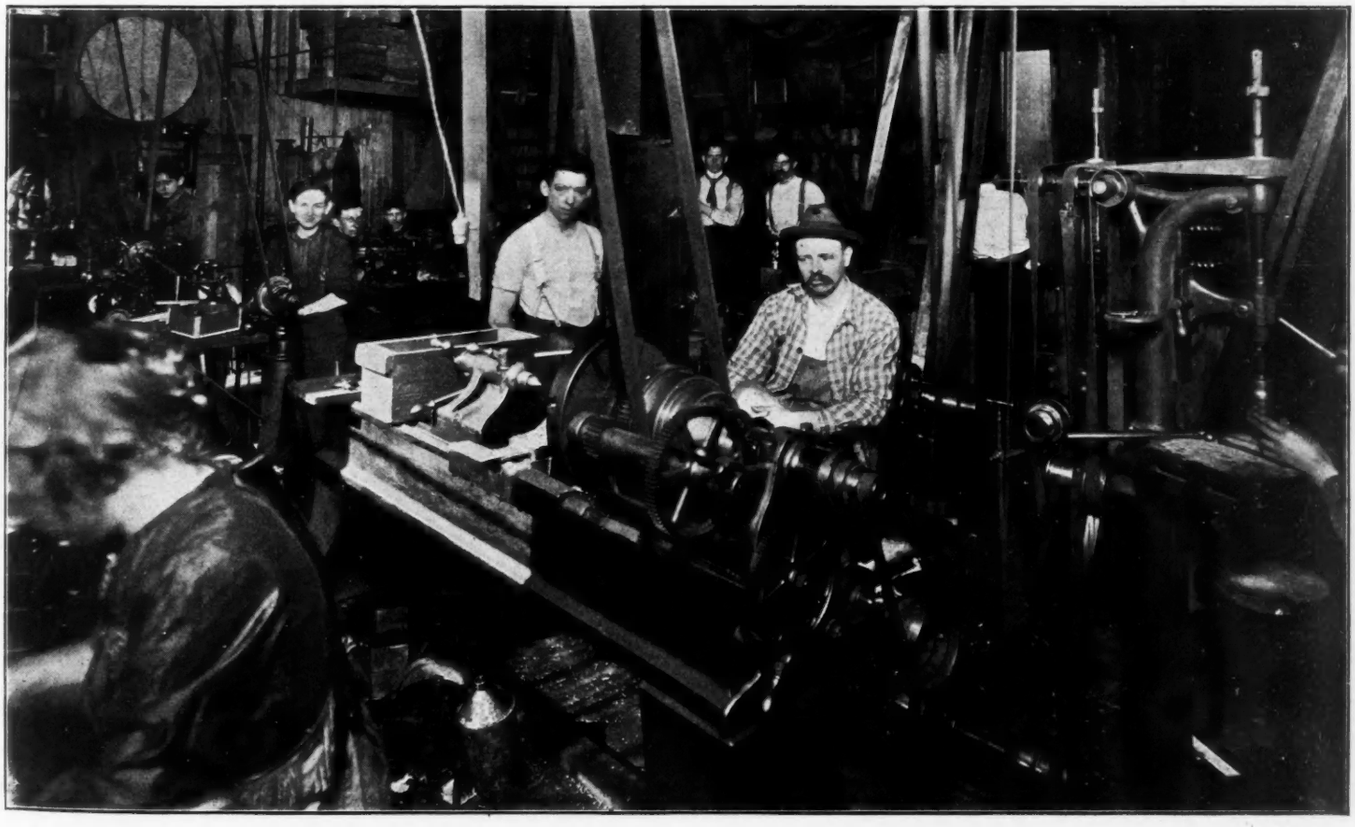
When the Harvard Company started it only manufactured a single type of protection, while now it manufactures over seventy types for use on telephones and telephone switchboards, so that it is now in position to quote prices and submit specifications on protectors for any sized exchange.

Of the personnel of the company, Mr. Fredric Greer is general manager and has been the principal factor in the company's success. He is assisted by Mr. A. S. Appleton, superintendent of factory; O. Hoffman, foreman of the tool and die department and Mr. C. A. Appleton, foreman of the fuse wire and link department.

HARVARD ELECTRIC COMPANY FACTORY.

GENERAL MANAGER'S OFFICE, HARVARD ELECTRIC COMPANY.

GENERAL OFFICES, HARVARD ELECTRIC COMPANY, CHICAGO.



MACHINERY DEPARTMENT, HARVARD ELECTRIC COMPANY, CHICAGO.

A SUCCESSFUL YOUNG MAN.

Mr. J. C. Finch, manager of the Chicago Pay Station Company, is an example of the successful young business man. He was born in Florence, Kentucky, and was educated in his native state. He took a post graduate course at the Cincinnati Technical School, after which he entered the employ of the Wilson & McCalley Tobacco Company of Cincinnati, remaining with them for two years. He then accepted the superintendency of the Manson Cycle Com-

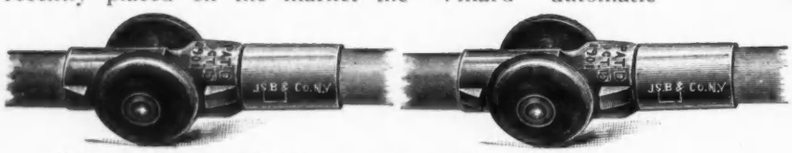
J. C. FINCH.

pany's factory, where he remained for five years, after which he associated himself with the Chicago Pay Station Company, accepting the position of manager.

Mr. Finch is an expert mechanic and electrician, and a man of considerable managerial ability. He has made many friends by his courteous manner and this, combined with his keen perception and shrewd business judgment, has placed him in his present position.

AUTOMATIC WHEELED CONDUIT RODS.

Messrs. J. S. Barron & Company, New York, have recently placed on the market the "Villard" automatic



"VILLARD" AUTOMATIC WHEELED CONDUIT ROD.

wheeled conduit rod, for which it is claimed that they are quickly coupled and uncoupled, are instantaneous in action, and will not buckle when being pushed through the conduit. In the construction of these rods special provision is made for their becoming rigid when pushed through the conduit and flexible when they are pulled, this provision allowing a considerable variance when crossing a manhole, and making it easy to take another duct out of line with the first, the rods becoming again rigid when pushed into the new conduit. It is said to be a physical impossibility for these rods to become uncoupled when in the conduits, as an angle of about 40 deg. has to be obtained before the joint can be separated. For the wheels to which the rods are run it is claimed that they save friction and wear on the rods themselves, enabling one man to work long lengths of rods, that they serve as duct cleaners and as a guide to the rods.

NEW MODEL CHICAGO PAY STATION.

In the advertising columns will be found illustrated and described a new model pay station which is being brought out by the Chicago Pay Station Company.

The cut below shows the new pattern and as will be observed it has three separate plungers for operating the coin channels, the object of which is to prevent the common mistake with single lever machines that on toll charges patrons deposit several coins and by pulling the single lever cause a confusion of signals. The three separate plungers completely cure this fault.

Another striking feature of this new machine is a win-

5-10-25
CHICAGO PAY STATION, PATENTED
No
DIRECTIONS.
Have Proper Change ready.
Do not deposit money until told to do so by the operator
Drop coins in proper slots,
ONE AT A TIME.
pushing the knob (behind the slot used) clear down for each coin until signal strikes, while receiver is
OFF THE HOOK.

NEW MODEL CHICAGO PAY STATION.

dow in the front of the case into which each coin drops after being deposited. The object of this is to prevent the use of spurious coins as each patron leaves evidence behind

him and thus renders detection of offenders easy. This device was adopted as preferable to a magnet which would throw out iron or steel slugs only, as a large majority of the spurious coins used are made from brass or other non-magnetic metals. Spurious coins are not extensively used to operate telephone pay stations, but a device like that shown above is valuable as a preventive.

Another feature of this new pattern is the long coin slot which prevents the use of wires or strips of metal to operate the signals.

For a more detailed description of the many good features of this new model pay station readers are referred to the advertising columns.

TRADE NOTES.

THE NEW HAVEN NOVELTY MACHINE COMPANY, New Haven, Conn., state, with regard to their "Novelty Slidable Sleeces," that they are willing to send samples, with "Y" branch and pot head for any individual piece, to responsible telephone companies for inspection and approval. After these have been tested they will quote prices and discounts. These goods they will also forward at their own expense.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has completed plans for an extensive addition to its plant. For some time the present facilities of the plant have been inadequate. The addition will be 175 feet long and 50 feet wide and three stories high. It will be used for general warehouse purposes. Another structure, 350 feet long and 56 feet wide, three stories high, is contemplated to furnish additional machine shop facilities.

MACHADO & ROLLER, New York city, manufacturers of electrical instruments, have concluded an arrangement with F. B. Sage & Brothers, under which they have taken over the exclusive manufacturing and selling rights for the ohmmeters formerly made by the latter company. These devices will be manufactured by the Whitney Electrical Instrument Company, for which Messrs. Machado & Roller are the general selling agents.

THE COUCH & SEELEY COMPANY, Boston, Mass., in its factory of 30,000 feet of floor space devotes an entire floor, or 10,000 square feet, wholly to switchboard work. Its switchboard line includes both central energy and magneto-call types for both transfer and multiple systems, toll line boards, hotel and small private plant apparatus, with complete facilities for building equipment to any specifications. Another department is occupied wholly in making central energy and magneto-call types of telephones, with a capacity for producing 100 complete instruments per day. Another department is given over entirely to "interior" apparatus, of which the company makes a large line, including automatic intercommunicating systems and similar types for every conceivable purpose. The personnel of this company is composed of the following: Francis H. Whitman, president; Raymond L. Whitman, treasurer; Elisha B. Seeley, general manager.

THE CHASE-SHAWMUT COMPANY, Boston, well-known manufacturer of electrical specialties, has entirely reconstructed its factory since the recent fire on a greatly enlarged scale. The number of employes now is doubled. Among the many novel improvements is the installation of a De Laval steam turbine for the generation of both power and lighting for its factory. This steam turbine, for which this company is New England agent, is attracting great attention on the part of those interested in the economic questions of power and lighting. The De Laval steam turbines have been for several years in successful operation in Europe. It is only recently, however, that the De Laval Company has entered this country, but the extensive works at Trenton, N. J., are already overtaxed to meet orders. The Chase-Shawmut Company invites inspection of this turbine, which is in constant and very efficient operation in its factory, 390 Atlantic avenue, Boston.

THE WILLARD STORAGE BATTERY COMPANY, Cleveland, Ohio, has just issued a new catalogue descriptive of Willard storage batteries. It contains a description of the various types of the Willard batteries. The new company claims to have made many important improvements over the old type of battery as manufactured by its predecessor, Sipe & Sigler, and announces that it is now ready to accept orders for storage batteries.

FOOTE, PIERSON & COMPANY, 82 Fulton street, New York, have issued a 72-page catalogue, large octavo size, containing almost 300 illustrations of apparatus of their manufacture, or instruments, etc., the sale of which the firm makes a specialty. The catalogue is divided into two parts, Part I being somewhat general, while Part II is devoted entirely to measuring and testing instruments. In Part I is illustrated and described a complete line of telegraph instruments, not less than 56 cuts being used to illustrate the principal items. Following the section is a description of an anemometer electric clock, designed for determining the velocity of the wind, which gives a direct reading of the number of miles per hour. Next come call boxes and a line of telephone apparatus, followed by sections on house bells, push-buttons, gas-lighting apparatus, fuse protectors, lightning arresters, primary batteries, wires, etc. The section devoted to instruments includes all manner of galvanometers, condensers, shunts, resistance boxes, Rontgen ray apparatus, etc.

STREET RAILWAY TELEPHONES.

Wider recognition is being given to the telephone as an aid to the operation of both steam and electric railway systems. There is undoubtedly a great field here for telephone engineers and manufacturers, and those who first organize systematic methods of invading it and of catering to the needs of street and steam railroads will surely reap a rich harvest within the near future. We read in the daily papers that the Berkshire Street Railway Company, operating in Pittsfield, Mass., has made a contract with the New England Telephone Company for the installation of a system of twenty-six telephone stations to provide communication between the power-house, car-sheds, sub-stations and each of the various switches along the line. The People's Tramway Company, of Danielson, Conn., is installing a telephone system which will give communication not only between the different departments, power-house, car-shed, offices, etc., but will enable every car to get in communication with headquarters from any part of the line. Each car will be equipped with a portable telephone set and a pole contact for tapping the line.

TELEPHONES ON TRAINS.

A train telephone has been installed on the Overland Limited train on the Chicago and North-Western Railway, which runs from Chicago to San Francisco in 2 days 21 hrs. 25 min., said to be the fastest long-distance train in the world. The telephone is connected to the central office at any town where the train stops by means of a cable attached to a tripod on the roof. An operator at the station is detailed to make this connection when the train stops.

TELEPHONY is the best telephone journal in the land.
F. A. BROOKS, Charleston, Ill.

Raw Material Used in Telephone Apparatus.

A Series of Articles by H. M. Deavitt.

MAGNET STEEL.

As nearly every article used in the construction of the telephone must have certain properties, and perform special work, it is necessary to look into its manufacture to ascertain the reason why one shipment will give excellent satisfaction, while the next consignment, which to the outward appearance is the same as the first, will not do the work at all. It is for this reason that the telephone manufacturer must use every precaution in the selection of his raw material, and be constantly on the alert that its quality is maintained, for a single mistake either in the material itself, or in its subsequent treatment, may not only cost him several valued customers, but will go far to undo the reputation he has striven for years to build up.

Magnet steel finds use in the telephone in the magneto generator in the form of horseshoe magnets, which must hold their magnetism in order to ring over long distances. In the receiver, where, if the magnet steel is not of a good quality, the core becomes demagnetized, and is not susceptible in a sufficient degree to reproduce the variations of the primary circuit.

What is magnet steel? It is a grade of steel of certain chemical composition which a long series of experiments have shown to be best adapted for retaining its magnetism.

The quality of magnet steel is dependent upon the amount of the five metalloids found in all iron and steel, namely, carbon, silicon, phosphorus, sulphur and manganese. It is the amount of these metalloids present in steel which give to it all its properties, either good or bad.

Most of the magnet steel offered to the trade to-day is made by the Open Hearth Process, consisting of melting down the charge on the hearth of a Siemen's regenerative furnace. There is what is known as acid open hearth steel, and basic open hearth steel, the difference between the two being a difference in the lining of the furnaces.

In the acid process, the furnace has a siliceous lining and no sulphur or phosphorus can be burned out. Consequently only iron having very small amount of sulphur and phosphorus can be used in the production of a high-grade steel. In the basic process, where the furnace is lined with lime or magnesia, the phosphorus can all be eliminated and also most of the sulphur.

In the open hearth furnace the pig iron and scrap are first melted, yielding a molten metal with too high a percentage of carbon, iron ore is then added to reduce the percentage of carbon, and manganese is also added by mixing with molten spiegeleisen. When the steel shows the desired analysis, it is poured into ingot molds, and these ingots are rolled into bars of any desired dimensions.

It should be noticed that inasmuch as the iron used is not all of the same composition, there are no two heats of steel exactly alike. The steel ingots are rolled into various sizes for a great variety of work, and steel which has been cast to be rolled into rails is not suitable for magnet steel. The steel manufacturer is not apt to appreciate what a difference a slight increase in the percentage of carbon, or phosphorus or sulphur beyond a certain limit has upon the magnetic properties of steel. The steel ingots should be selected according to their chemical composition before being rolled into bars of magnet steel and to avoid trouble, the telephone manufacturer should see that there has been no mistake in the selection of the ingots, and I know of no better way than to have specifications covering the chemical constituents of the steel.

The importance of having magnet steel of the right composition will be appreciated, if it is realized that no matter what subsequent treatment it may receive, if the stock from which it is rolled is not right, all subsequent time and labor spent upon it is wasted, and the finished product thrown away.

During the past year, the large and progressive telephone manufacturers have come to a point where, instead of taking any steel which might be sent them whether adapted to their use or not, are carefully inspecting their purchases, and instead of working in the dark, are able to tell from their finished product at what step in the manufacture a mistake, if any was made. The up-to-date telephone concerns are not satisfied to have someone else tell them what their magnet steel should contain or does contain, but must know for themselves. In a short time, by carefully comparing the analyses with the workings of the different shipments, it is possible to tell in advance from the analysis of the steel what the magnetic strength will be if properly hardened.

Next in importance to good material is the proper hardening of magnets, for while ordinary steel will take magnetism, it must be hardened in order to retain its magnetism for any length of time.

The hardening of steel is so important, and is such a marked phenomenon, that it has always attracted a good deal of attention, and many theories have been put forth in explanation of it. Previous to the time chemistry was brought to bear upon the subject, the proposed theories were based upon assumption, and, being without proofs, one had as much right for consideration as another, and none of them were satisfactory. Since science has taken up the question a great deal of experimental work has been carried on by various investigations, and while their theories are not all uniform, so much work has been done along this line that from certain material of known composition, certain results are sure.

Steel is very sensitive to heat, and because it is so sensitive the effect of the metalloids of phosphorus, carbon, manganese, sulphur and silicon in steel are best shown when the metal is in or has passed through the heated state. When steel is heated it begins to show color at about 700° to 800° F.; the first color is known as dark cherry red or, better, orange red. Above this color it turns to a distinct, rather dark or medium orange color. If the heat is increased a bright lemon or cream color appears. A cherry red is the usual temperature to which steel is heated for hardening magnets; but this heat is modified according to the quality of the steel or according to the amount of carbon it contains. A high carbon steel is least heated. A color-blind person can never learn to harden steel properly.

A steel is said to be red-short when it is brittle and friable at what is commonly known as a low red heat. Red short is caused by a too high percentage of sulphur, and is difficult to work when hardened, and it is almost certain to crack at a bright orange heat. Hot short steel is that which cannot be worked at a high heat, say, above a medium orange color. Steel containing considerable quantities of silicon, tungsten, manganese are generally hot short. Cold short steel is steel, which is weak and brittle when cold, either hardened or unhardened. Too high a percentage of phosphorus causes this, and it must be plain that no one can have any use for cold short steel.

From the preceding it is clear that to get good results the percentage of sulphur and phosphorus present in the steel must be kept as low as possible. Care must also be exercised in the hardening that additional sulphur and phosphorus are not supplied. These elements may be added to the steel either from very impure coal or coke used in heating or from using it to chill water, which contains a high percentage of sulphur. There are many recipes and

patented hardening fluids, but none of them which have come to my attention seem to have any special merit. The following liquids for chilling steel are arranged according to their activity: Mercury quickest, brine next, water next and then rapeseed oil.

When a piece of steel is to be hardened by quenching in water, it should be heated with great care to the exact temperature to produce the required hardness. The maximum hardness and the best grain for magnet steel comes from cooling it in the quickest possible way. In doing this the steel is subjected to the greatest shocks or strains, and great care must be used. If a piece of steel is heated, no matter how unevenly or to what temperature, and is allowed to cool slowly and without disturbance, it will not break or crack under the operation. If the steel be heated so unevenly as to show different colors at different parts of the bar, it is almost certain to crack when immersed in the water, if it contains enough carbon to harden it. It is the presence of carbon and manganese in steel which hardens it.

It will be seen from the foregoing what an important part the various chemical elements take in regulating the properties of magnet steel, and although it is without the bounds of this paper to take up the various percentages of the metalloids as usually found, and trace the different properties of the steel to the changes in its composition, nevertheless it is a subject on which careful study has gathered valuable information.

If it is remembered that the cheapest raw material in the long run is that which best answers the purpose, is it not necessary in order to intelligently select such material and also to give it proper treatment in the operations to follow in its manufacture to know as much as possible regarding its composition?

TOLL RATES AND TOLL DIVISION.

BY H. C. WINTER.

This subject though of prime importance and vital concern to all telephone companies and subscribers is one that by its nature is abstract and dry and it is a difficult undertaking to make it interesting. However there must be something sobering to counteract and offset the social, jovial and pleasure side of convention life and this paper will, no doubt, serve that purpose well.

The establishment of a common schedule or basis by which to regulate combination tolls and an equitable division of that toll among the companies transmitting such messages is specifically stated in the constitution of our association as one of the objects of its organization. At the first meeting held at Weyauwega some two years ago this was the subject that received the most prominent and general discussion and although no action was then taken in regard to the same it was the sense of the convention that this was one of the problems calling most strongly for associated action. At the two following meetings this subject was again discussed at considerable length and a committee of three was appointed to consider and report a plan for regulating and dividing such toll rates, but the committee was unable to agree upon a satisfactory plan and no report was adopted. In the legislature in session at the time of the convention a bill had been introduced compelling the different telephone companies to connect with each other and imposing heavy penalties for refusal and the association adopted a resolution strongly opposing any such legislation and the Bell company also opposed such bill and it failed of passage. Had such bill passed you would not now be obliged to listen to this effort on the subject.

At the La Crosse meeting a year ago a resolution was adopted that a committee of three be appointed to formulate a schedule of toll rates and a division thereof between companies transmitting the same; and that an agreement be prepared upon the basis of such schedule and that an effort be made to secure the agreement of all independent companies in the state thereto, to commence and take effect at a stated time. This committee made its report at the last Milwaukee convention and its plan was the same as that adopted at a meeting of the Executive Committee at Weyauwega, March 26, 1901, which was as follows: Such combination toll to be two-thirds of the sum of the local tolls and to be divided on the basis of one-half of the sum of the air line and pole line distance between the entering and outgoing stations of the companies transmitting such message and figuring exchanges through which said message passed equivalent to three miles of line. A committee of six was then appointed to further consider this report and make a new report the next day. At that time the committee was not ready to present its report and requested further time to consider the subject, which was granted, and the committee was directed to report at this meeting. Thus the association has resolved and resolved and committees have reported and considered and again reported, but nothing tangible has as yet been accomplished and the hope of starting a discussion that will crystallize into a substantial and practical plan is the motive of this article.

There are two distinct parts to this subject: the fixing of the rate and the division of the toll among the different companies handling the message. Almost the first question that suggests itself in considering the rate is whether the charge should be based on the distance and if so on the pole line or on the air line distance between the stations.

The cost of transmitting a message is made up of two distinct factors; the operating expense and the construction expense. The operating expense comprises the expense of the exchange or station, operator's service, the accounting and collecting of the toll, etc., and this expense is only very indirectly and practically not dependent upon the distance. Hence the cost of transmitting a telephone message usually does not vary with the distance as it involves no more expense or trouble to transmit a message from A to C than it does from A to B, even if C is twice as far distance, assuming of course that their stations are in the same circuit. Stating it abstractly the operating cost of transmitting a message over a portion of a circuit is exactly the same as transmitting it over the entire length of the circuit. The operating expense of a message, however, does not depend upon the distance to the extent that the additional distance involves handling by additional exchanges and circuits, but to that extent only.

By the second factor of cost of a message, the construction expense of transmission, an awkward expression perhaps, is meant a term that can be estimated only approximately. It means a quantity derived by dividing the total construction cost of a line by the probable number of messages that can reasonably be expected to pass over the line during its life. This item depends directly and entirely on the distance; the length of a line determines it absolutely. It is relatively not as important an element in the total expense as the former. So the total cost of transmitting a message depends on these two differentiating factors, one depending only partially and indirectly on the distance, the other varying directly and exactly with the distance. You recognize the latter factor when you charge more for a 20 mile message than for a 10 mile message. You give recognition to the former factor when you charge less per mile for a long distance message than you do for one going a shorter distance. The cost of transmitting a message, although it may not be the determinating element in the price, is, however, of considerable importance, and must not be overlooked. The notion that a toll message can be handled at a trivial or nominal cost is an erroneous and nefarious one and one that accounts to a great extent for the slashing of toll rates by thoughtless and inexperienced companies. It may seem needless to say that the cost of a mes-

*Paper read at the Wisconsin Independent Telephone Convention, Waupaca, June 25, 26, 27.

sage should never equal or exceed the toll, yet I know of numerous instances where this is the case, where the business is handled at a positive loss.

The next phase of considering distance as affecting the price is, should the air line or the pole line distance between the stations determine the toll? Inasmuch as the cost of transmitting is only partially dependent on the length of line and as it cost partially very little more to transmit a message a round-about 20 miles than it does the 10 miles straight across, it seems logical to base the rate on the air line rather than on the pole line distance. Telephone companies are common carriers and comparing the charging system of railroads we find that the railroad charges according to the track mileage no matter how circuitous may be the route. With the railroad both the operating expense and the construction expense of transporting varies directly and entirely with the distance traveled and hence it is entirely just and proper to fix the charge according to the mileage and disregard entirely the air line distance. For most commodities and services the cost bears a close relation to price, but in the transportation and telephone business this need not necessarily be the case. For the great majority of commodities the railroad, though not entirely, is practically a monopoly. In a like manner the telephone company is also practically a monopoly, and although not entirely so, it approaches the perfect monopoly more nearly than does the railroad company. In a business that is by its nature a monopoly, like a railroad and the telephone, the price is not closely related to the cost and the price is usually fixed as high as the business will stand, although it must not be prohibitory. The prime consideration is to so fix the toll that it will bring the maximum net return. No one will dispute that a reduction in the toll means an increase in the number of messages. But as a business proposition five messages a month between two stations at 20 cents each, amounting to $1, is better than ten messages at 10 cents a piece, which also amounts to $1, and unless such messages increase at least two-fold the reduction in toll has been made at a net loss notwithstanding the additional business for the increase has not been sufficient. Each message has a cost and in addition it should be remembered that the transmitting capacity of a circuit is necessarily limited, and when a circuit is worked up to its limit or nearly so, it means that there is much inconvenience and waiting all along the line, which means ultimately loss of business, for it becomes the rule to limit a person to 15, 20 or 30 minutes for his party because the line is busy, he will figure this waiting as part of the cost to him in telephoning, and in the long run it will not be found to pay to keep the line busy with cheap messages. The promoters of one of the large toll line companies in this state gave to each purchaser of stock a pass entitling the holder to unlimited use of the toll lines, and while this pass feature may have made pass selling somewhat easier it worked havoc with the toll receipts. One difficulty was the fact that the passes were nearly always held by parties who would have been the heaviest users of the toll lines and thus much prospective revenue was cut off, but the main difficulty was that whenever cash customers wanted to use the lines they were always busy and kept busy by the pass or dead head messages. The company was finally forced to cancel the passes and will henceforth have a legitimate excuse for existence. When any company thinks it can handle toll messages without cost to itself and that it can permit the use of its lines a portion of the time without receiving any return therefor, it is high time for the appointment of a guardian. I am a firm disbeliever in cheap toll rates nor do I advocate an excessive rate, but the toll should be reasonable and should be fixed at that point where the total net revenue will be maximum. There seems to be a general tendency to reducing toll rates and whether this be wise or otherwise I will not presume to state. Suffice it to say that although it requires no mental effort to reduce a rate it does take a great deal of tact to again restore without friction a rate that experience has proven too low. In some states the law provides for an official who has power to regulate telephone rental and toll rates but in Wisconsin there is no such official to either help or hamper the business. When such an office is created no doubt the best wire puller will land the job and your trouble will begin. The only action the association has taken in regard to the adoption of a standard for fixing toll rates was at a meeting of the Executive Committee about a year ago and the standard there adopted was also adopted by the committee on tolls in its report to the Milwaukee convention, but no action was taken by the convention in regard to such report. This rule which I formulated and introduced at the executive meeting was as follows: Such combination toll to be two-thirds of the sum of the local toll and to be divided on the basis of one-half of the sum of the air line and pole line distances between the entering and outgoing stations of the companies transmitting such message and figuring exchanges through which such message passed equal to three miles of line. This is an awkward attempt to compromise between the air line and pole distance theory and is illy suited for the purpose intended. I will not enumerate its many defects but throw it overboard without further comment.

Some companies base their rates, after a fashion, on air line distance; others on pole line distance; most of them on an awkward combination of the two, but with very few exceptions rates are fixed in a haphazard, happy-go-lucky sort of a plan in which system and uniformity are most conspicuous by their absence.

The most feasible and logical plan for regulating rates that has yet been suggested is the zone system in which the distance is figured solely on the air line basis and the pole line distance is entirely disregarded. Here the charge is based directly and entirely on the service rendered and the patron pays exactly for what he gets. This is eminently just and fair to the patron and no matter over how many round-about circuits or through how many exchanges the message must pass the charge is exactly the same. As if the pole line was an air line route. The great and decisive advantage of this plan is its extreme simplicity and that should be the paramount consideration. The zone system has been adopted generally by the Michigan independent telephone companies and has been found entirely satisfactory in practice. To determine the rates from any given point by this system with the point as a center draw a series of circles with the radius increasing regularly. The stations within the first circle will have a 10 cent toll; those between the first and second circles a 15 cent toll; those between the second and third a 20 cent toll, etc., the toll increasing 5 cents for each additional circle. The radii of the circles must of course be fixed arbitrarily and can be so regulated as to make the toll high or low just as desired. As it is invariably the practice among independent companies to charge less per mile for the long distances than for short distances, the rate per mile diminishing as the distance increases, a radius increasing arithmetically will give us rates that do not conform to this practice, for then a 50 mile message would be exactly as much as one for 25 miles. Yet a radius increasing in a geometric ratio would make the long distance tolls altogether and relatively too low, for then an 80 mile message would be only twice as much as one for 10 miles and as the distance becomes greater the relative disproportion would become still more pronounced. So the problem becomes one of increasing the radius in a manner uniform and regular and yet make the tolls for the increasing distances reasonable and fair. The plan I here suggest is less arbitrary than any which has been offered, in that the radius increases regularly each time and is as follows: Make

[Concluded in September TELEPHONY.]